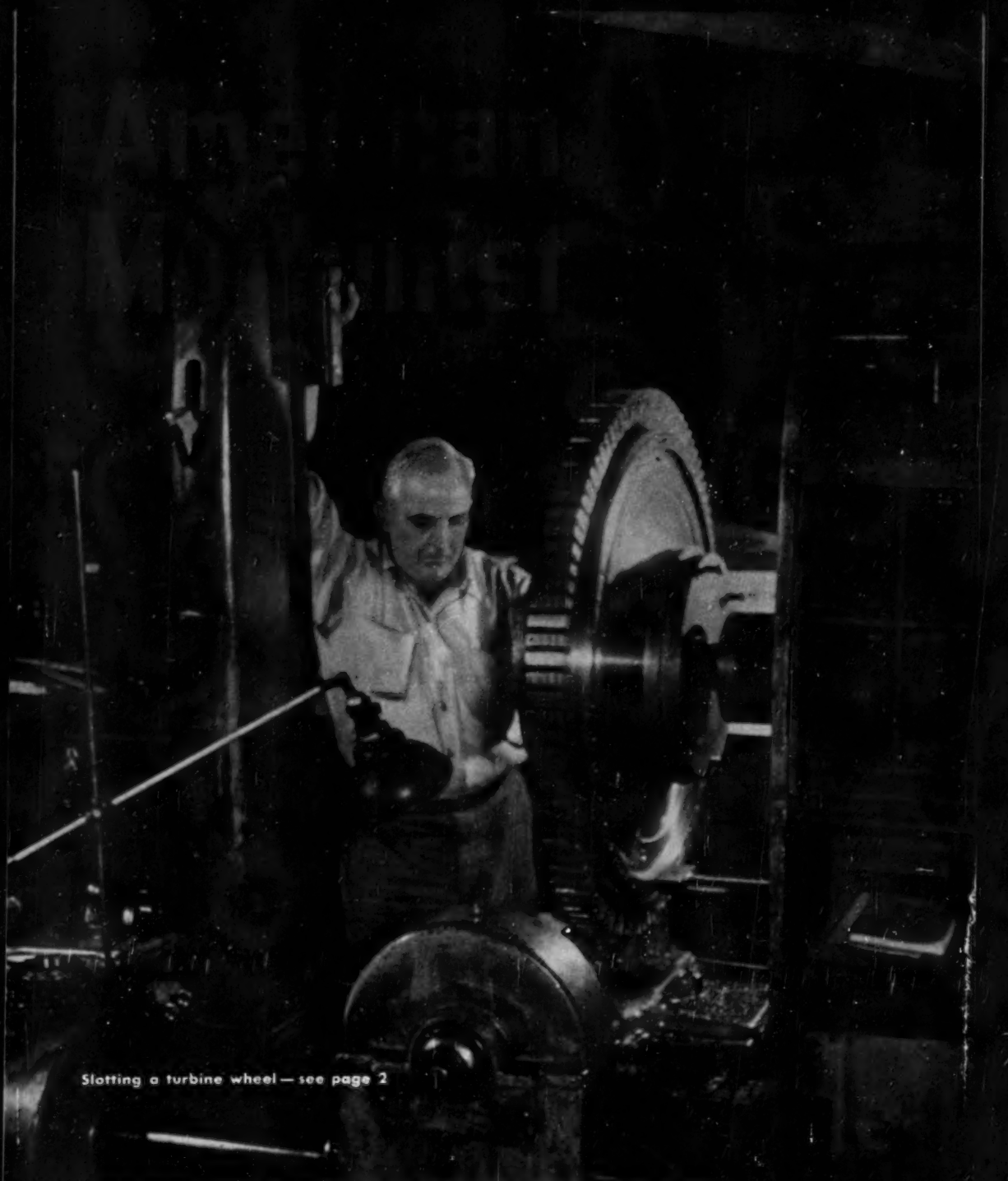
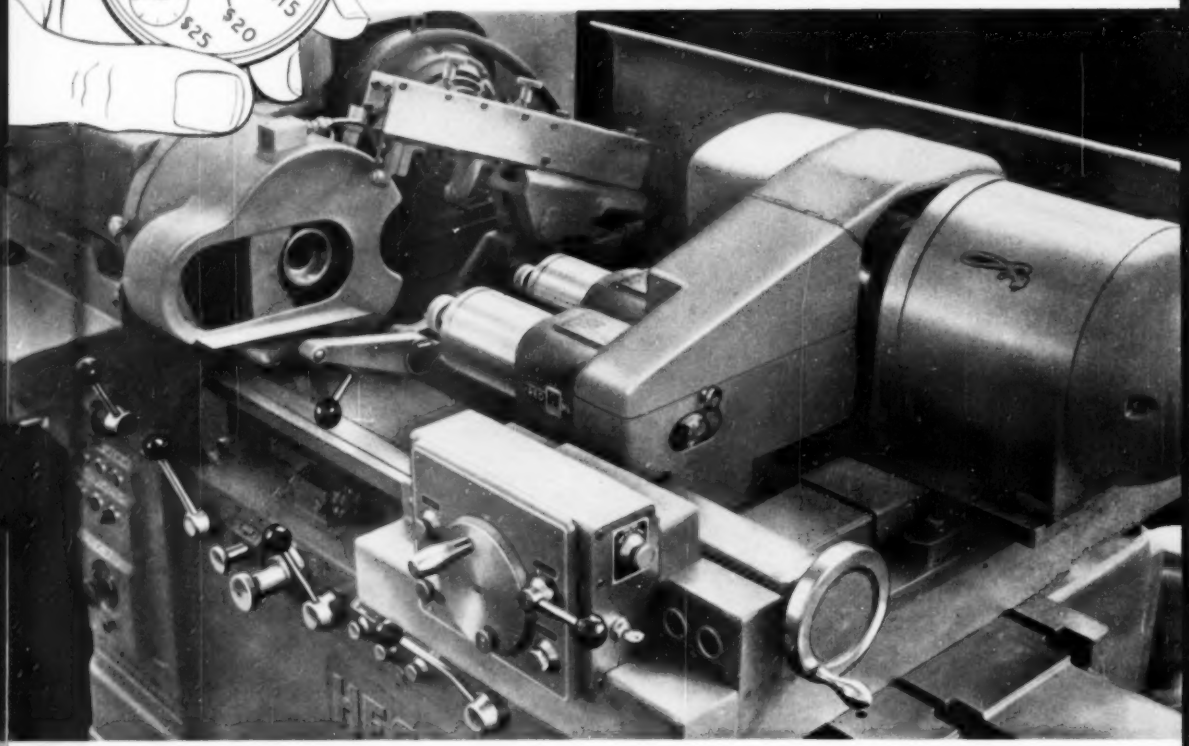


Slotting a turbine wheel — see page 2

NEW PLANT CUTS OVERHEAD VIBRATION IN MACHINE SHOPS

here's the real measure of cost reduction—by Heald



Time your production in dollars as well as seconds

Today — more than ever before — minutes saved are dollars earned. Even a few seconds per part can add up to *hours* in a single shift. And by the week or month, the total savings can be a mighty important factor in your cost picture.

All of the new Heald machines have been designed with this in mind — to help you do a better job, faster, easier, and at lower overall cost. Remember, when it comes to precision finishing, it pays to come to Heald.

This Heald model 271 internal saves 20 seconds per part

Steel gears used in automobile production are precision ground on two diameters and a face in a single, high-speed automatic cycle. Two wheelheads are used — one grinding the inner bore to 1.9205" — 1.9210", and the other grinding the inner face and outer bore (2.8760" — 2.8765") at the same time. Work is held in an easy-loading diaphragm chuck. Bore size is controlled by the Size-Matic method.

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American Machinist

MAGAZINE OF METALWORKING PRODUCTION

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Chips and QUIPS

Slotting . . . Milling slots in periphery of low-pressure turbine wheel on a semi-automatic milling machine in the shops of the De Laval Steam Turbine Company, Trenton, N.J., is pictured on our cover. Slots being milled are for the bulb-and-shank type of blade fastening used on turbine wheels in the low-pressure end of a multi-stage turbine. A "straddle T" type blade fastening is used on wheels in the high-pressure end. The top and root sections of the blades will be machined after the blades have been inserted in the wheel shown here.

Shakes . . . Everybody knows of a case or two in which shop vibration raised hob with a precision job. But few really basic investigations have been made. We've got results of one—from Karhula, Finland, that shows some things you'd expect, and some you wouldn't. It will repay your close study, perhaps save you from the detrimental results of a case of shop "shakes."

Something Basic . . . We continue to feel that you expect from us real help in the basic job of training shopmen — that all our content should not be at your own level, but some should be of the type you can pass on down to the men coming up. So, in this issue, Associate Editor Linsley gives the essential dope on the first and most basic tools—the hand tools that still play such a large part in setting up, tooling, and the like. It's a Special Report on Hand Tools, one which you may want to get copies of for your apprentices and journeymen. The sketches are many and the text is short and sweet. If you want reprints, we'll have them at a nominal price.

Overhead Down . . . By correct layout and good handling, Clark Equipment Co. has cut manufacturing overhead 10% in the new Jackson, Mich., plant. That's equal to cutting direct-labor cost 30%. Because this is essentially a production job shop, and principles applied can be utilized by any other shop, regardless of size, we thought you'd want to know about it. So Associate Editor Rowan went out there, got the details for our lead story. We've tried to tell the story as much as possible with pictures. Included are special fork trucks, combining three plants into one, direct-line production, and so on.

Shorties . . . As usual, we provide several nugget ideas. There's one by George Hieber of Landis Machine Co. showing how to determine the squeeze of a vise, another describing an on-the-spot inspection setup to reduce scrapping of valves, a third describes a sectional cutoff and pierce die, a fourth the use of buttons in a special fixture. They all outline the idea and give essential details quickly, then let you get on to something else that's new and usable. Each could take a couple of pages — making our job easier, but your reading tougher.

New Twist . . . Out at Allis-Chalmers, they have a tricky problem in holding forage-harvester blades. Like those in the family lawn mower, the blades have a helical twist, must then be machined to hold concentricity within 0.005 in. W. H. Lang, superintendent of the machine shop, shows us the fixtures they dreamed up to accomplish this.

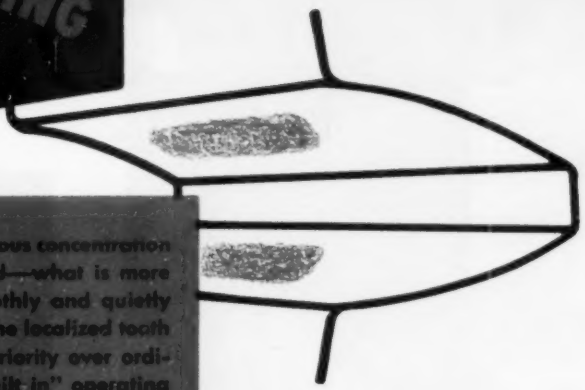
Form Tools . . . Screw-machine tooling is always a source of real cost savings, and a difficult subject about which to get printable material. We've got one in this issue, however, from Hartford Special Screw, on form tools. We think you'll like it.

Coming . . . June 12 *AM* has several features, a Special Report on Selection of Presses, by Sergius Brootzkoos; a description of the old, but little-known, process of "kneading" steel, plus some data on coining; an explanation of how to select power source for plating; a story of spectacular success in milling hard materials with carbides; and a group of tooling articles that show real cost savings. There'll be more of Martellotti, and our usual departments, too.

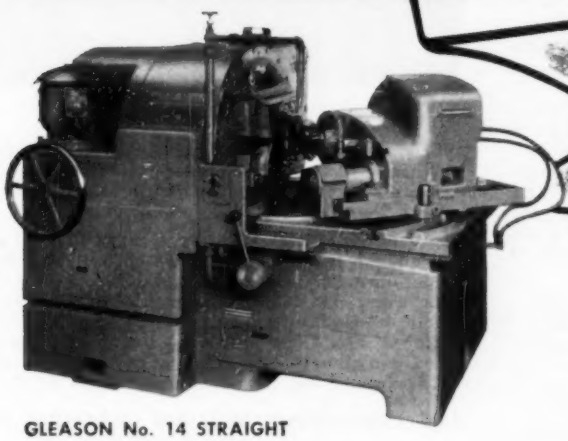
LAYOUT MAN . . . Herbert C. Lindberg is an estimator on screw-machine and related operations at Hartford Machine Screw Company. He is a graduate of New Britain (Conn.) High School and E. C. Goodwin Technical School in mechanical drawing, and went to work for New Britain Machine Company ten years ago. After four years of drafting, tool, jig and gage designing, which included some supervising and estimating, he had a two-year stretch in the Navy. In 1946 he returned to lay out the 300-machine new plant of New Britain Machine, then did screw-machine layout and trouble shooting for close tolerances. He also worked as layout man on electronic equipment for Allen B. Cardwell Corp. for six months, then joined his present employer. His article on form tools for multi-spindle screw machines in this issue is drawn from his combined background.

CONIFLEX GEARS

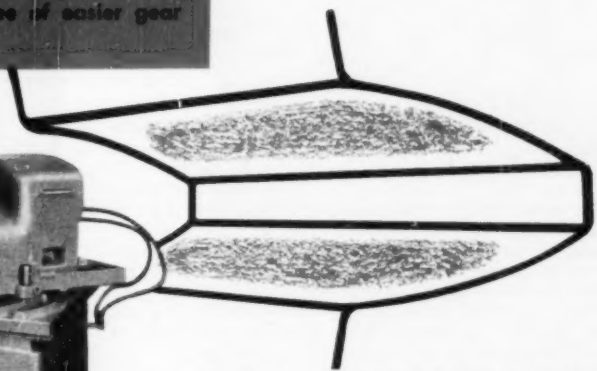
with WIDER OPERATING TOLERANCES



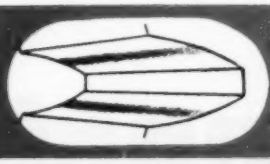
Coniflex* gears have no dangerous concentration of load on the ends of the teeth and—what is more important—Coniflex gears run smoothly and quietly with a safe distribution of load. It is the localized tooth bearing that identifies Coniflex superiority over ordinary straight bevels . . . it is the "built in" operating tolerance that provides safe distribution of load. This "built in" feature, automatically produced during the cutting operation, is your guarantee of easier gear assembly and ideal gear operation.



GLEASON No. 14 STRAIGHT BEVEL GENERATOR



The Gleason No. 14 Straight Bevel Generator is the Coniflex generator for medium size gears. Other models are available for the cutting of gears for small tools and appliances or for large industrial gears. These machines are all equipped with simplified controls to produce a Coniflex bearing during gear manufacture.



Straight bevel gears cut on previous machines usually run under load with a full length bearing or with bearing concentrated dangerously at the ends of the tooth. Coniflex gears eliminate this problem.

*Reg. U. S. Pat. Off.

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Builders of Bevel Gear Machinery for Over 85 Years

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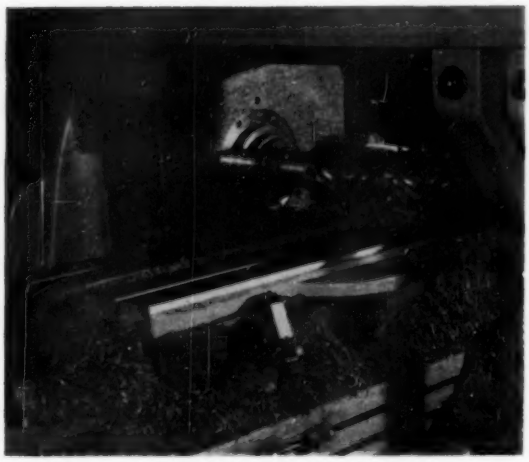
CINCINNATI No. 2 Cutter and Tool Grinder. Available with plain or universal equipment. Catalog No. M-1618-2.



Cutters are not worth their salt unless they cut chips *fast* . . . as fast as the "chip making" machine can push them and quality specifications permit. Of course, there's an economical limit, for the price of the cutter and its sharpening operations are figured in the cost of your product. The way to keep this cost element low is to sharpen the cutters *quickly* and *accurately*. That's just exactly what CINCINNATI No. 2 Cutter and Tool Grinders will do for you. Here are three reasons why CINCINNATI No. 2's are so proficient in helping you obtain the end result of most economical number of pieces per grind:

1) Antifriction table slide rolls on balls . . . easy to operate; no gibs; straight line motion in hardened and ground V-ways; easy and inexpensive to replace balls and ways.

2) Cartridge Wheel Spindle Assembly . . . preloaded antifriction bearings, protected from grit and lubricated for life; can be replaced with a new low priced assembly in a few minutes.

3) Fixed Height Table and Adjustable Height Wheelhead . . . convenient working height for every setup; column protected by bellows guard —no wear.

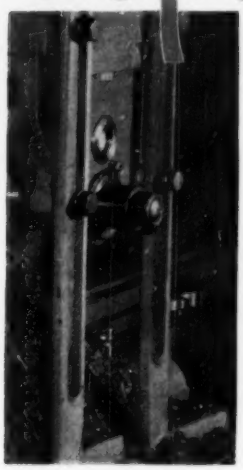
These three features—Cincinnati originals—are reason enough why you should select CINCINNATI No. 2 Cutter and Tool Grinders for most of your cutter sharpening and allied grinding operations. They're reason enough why older cutter grinders should be replaced now. Of course, there are many other features, and all help to reduce your costs. May we send our literature? Ask for publication No. M-1618-2.

THE CINCINNATI MILLING MACHINE CO.
CINCINNATI 9, OHIO

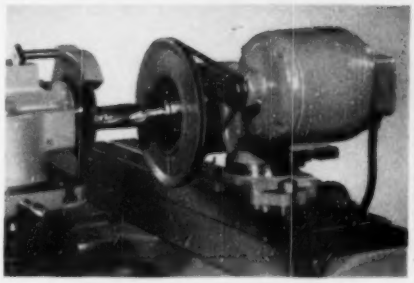
CINCINNATI

Cincinnati

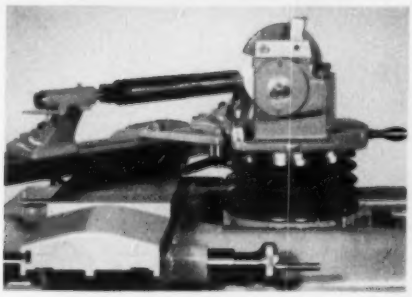
Cutters Chips



Grinding a shell end mill. The operator of a CINCINNATI No. 2 Cutter and Tool Grinder can work where it's most convenient — in this case, rear right-hand position.

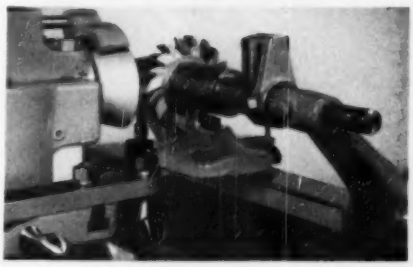


Salvaging a helical end mill. With the aid of the Circular Grinding Attachment, the damaged end can be readily cut off, after which new end teeth can be ground into the cutter.

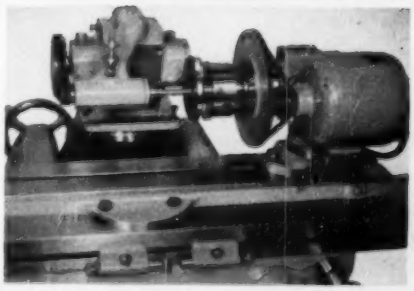


Grinding the corners of the blades in hand reamer. The CINCINNATI Cutter Grinder table can be disengaged and swiveled to any angle; 180° if desired.

REPLACE WITH A *NEW* CINCINNATI

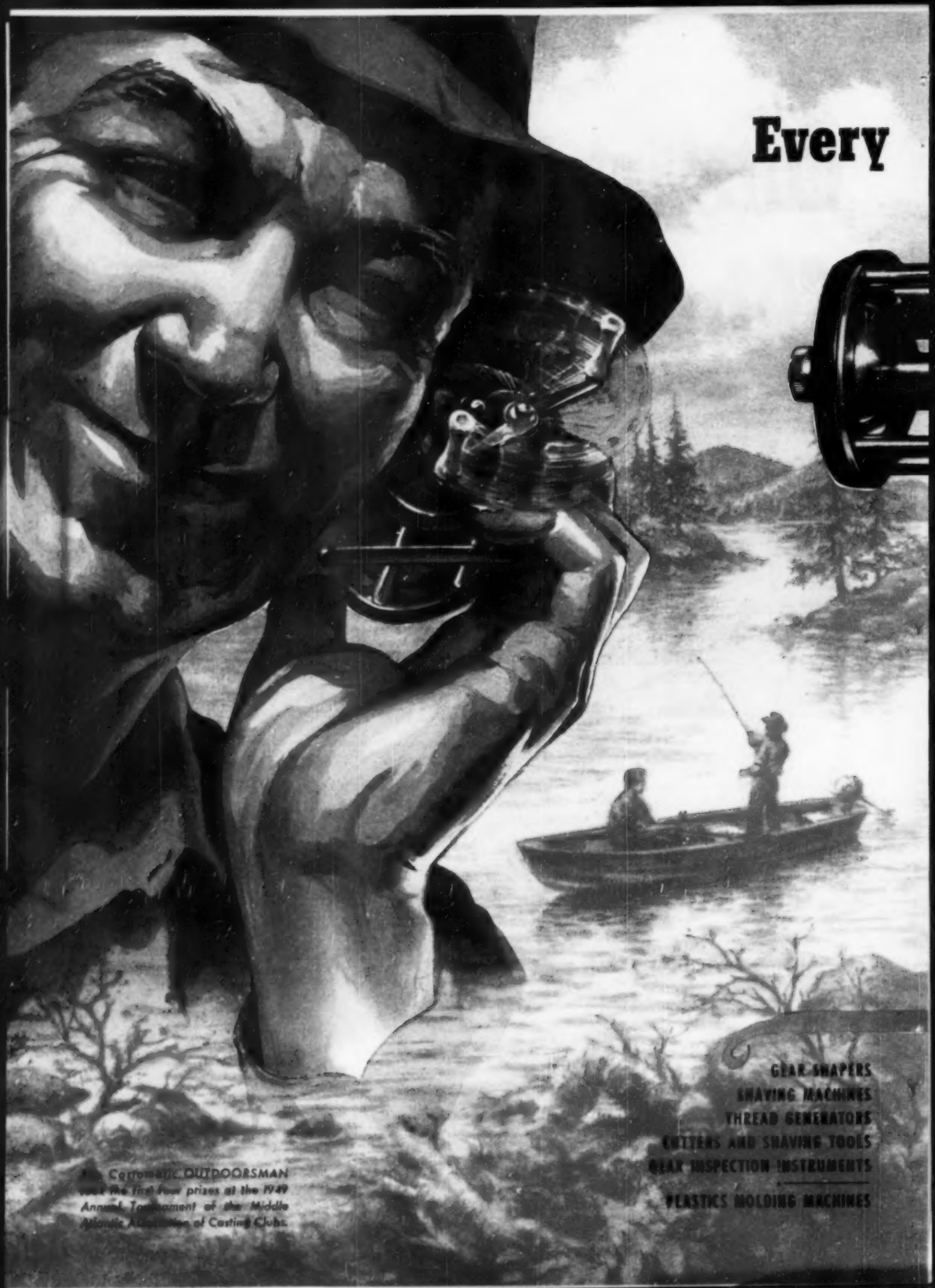


Stagger tooth slotting cutter; sharpening the periphery of the teeth, all in one setting. Cincinnati conveniences—tailstock clearance setting dial and universal toothrest—greatly facilitate work of this type.



Grinding the bore in a cam. Internal and Circular Grinding Attachments are part of the standard equipment supplied with CINCINNATI No. 2 Universal Cutter and Tool Grinders.

MILLING MACHINES • BROACHING MACHINES • CUTTER SHARPENING MACHINES
FLAME HARDENING MACHINES • OPTICAL PROJECTION PROFILE GRINDERS • CUTTING FLUID


Every
GEAR SHAPERS
SHAVING MACHINES
THREAD GENERATORS
CUTTERS AND SHAVING TOOLS
GEAR INSPECTION INSTRUMENTS
PLASTICS MOLDING MACHINES
The Gyromatic OUTDOORSMAN won the first four prizes at the 1949 Annual Tournament of the Middle Atlantic Association of Casting Clubs.

Outdoorsman's *a whispering*

Low Cost FELLOWS-Cut Gears Combine Superlative ACTION with Superlative QUIET..

The 3 inch Fine-Pitch Gear Shaper cuts this 9/32" face, 12-tooth 54 D.P., .220" P.D. pinion of SAE 1112 steel at 1200 strokes per min. The mating 5/32" face, 48-tooth gear of naval brass is cut at 2000 strokes per min. Time, floor to floor, is 35 and 45 seconds respectively.

In manufacturing gears for the popular-priced Castomatic OUTDOORSMAN, the Quaker City Gear Works, working with Fellows engineers, evolved a new 15° helix angle "quadruple multiplying" pair of gears—one steel, and the other brass. They are cut at cost-saving speed on the little Fine-Pitch Gear Shaper. Phenomenally quiet through the accuracy inherent in generated involutes, the action has ideal smoothness and freedom of spin. Better reels are in the offing, for all fishermen!... The same Fellows 3-Inch Fine-Pitch Gear Shaper has speed capacity (up to 2,000 strokes p. m.) to produce precision gears for any industry with eye-opening economy. Investigate—and cut better gears for less money!

This machine can be arranged with magazine attachment for automatic loading and unloading of stem pinions, ganged thin blanks, etc.

Fellows

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MORSE *Electrolized* DRILLS

"... produced 1600 holes in cast iron before sharpening; 900 after sharpening. Best previous performance 200 holes. 2 hours of set-up time saved in 8-hour period."

MORSE *Electrolized* REAMERS

"... report 7,000 pieces per reamer, against 1400 pieces formerly obtained. Reamers were run in an automatic, on high-carbon bar stock."

from USERS of:

MORSE *Electrolized* TAPS

" In SAE 1010 hot-rolled bar, one tap produced 12,400 pieces before grinding —1500 on 1st grind and 1909 on 2nd. Previous taps averaged 300 holes and were then worn to low limit. "

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" . . . cutting a slot 1¼" deep, this tool produced 200 pieces in a poor grade of aluminum and still looks like new. Same cutter, not Electrolized, would not even complete 1 piece without galling. "

(Name of any user furnished on request)

. . . here's how the MFD* proved we can't afford to use <u>any</u> Cutting Tools <u>except</u> MORSE- *Electrolized*

Seeing is Believing—TRY THEM!

*MFD—Morse-Franchised Distributor.

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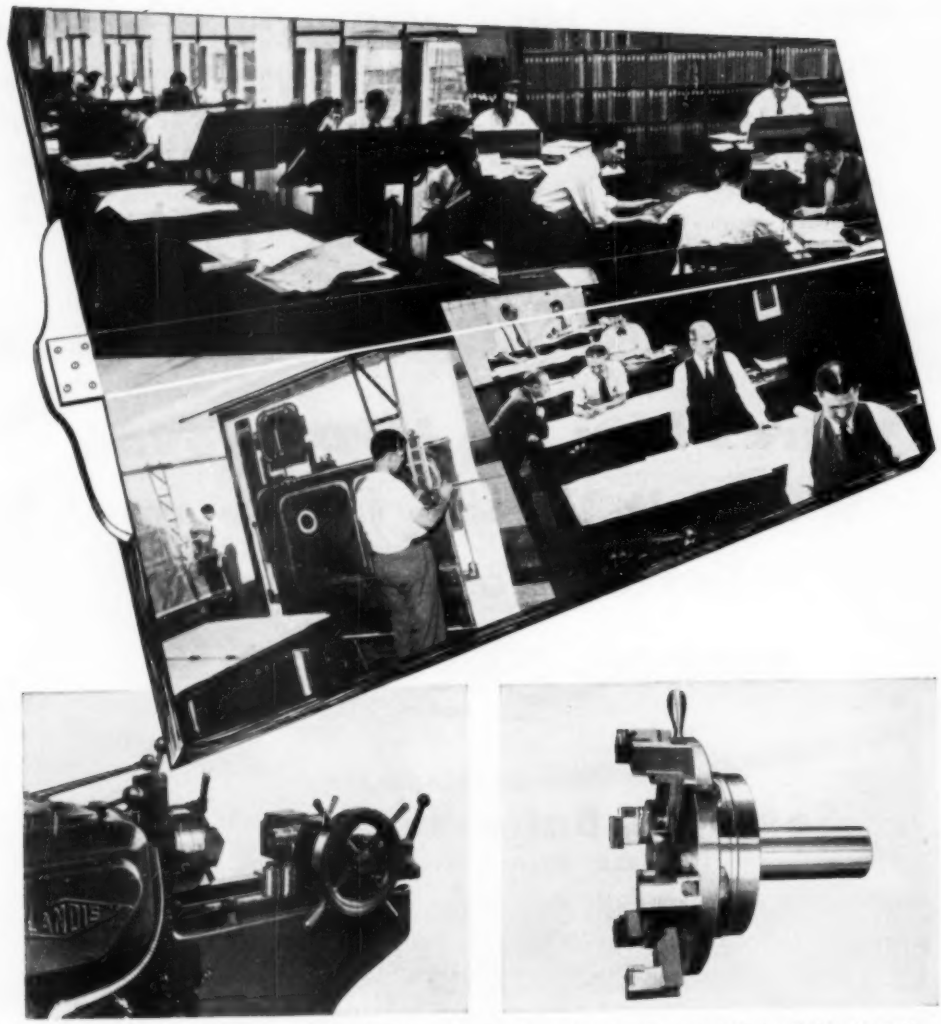
MORSE TWIST DRILL & MACHINE COMPANY

NEW BEDFORD, MASSACHUSETTS, U.S.A.

A DIVISION OF VAN NORMAN COMPANY

BRANCH WAREHOUSES: NEW YORK, DETROIT, CHICAGO, SAN FRANCISCO

A COMPLETE *Thread*



A 1½" Single LANDMACO Machine equipped with special work holding fixture for threading adapter sleeves.

A Special Die Head (LANDMATIC 40AXX) designed and built to thread valve seat rings up to diameters of 14¾".

● *THE WORLD'S LARGEST EXCLUSIVE MANUFACTURERS*

Engineering Service

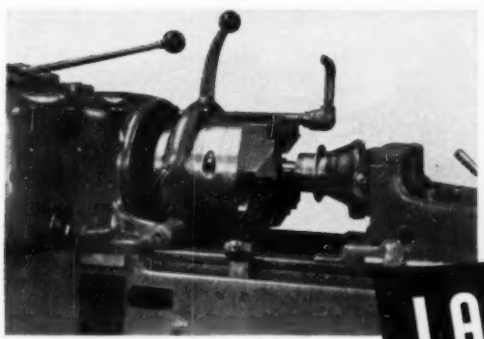
- **PRODUCT DESIGN**
- **PROCESS DEVELOPMENT**
- **ALL TYPES OF THREADING EQUIPMENT**
- **SPECIAL APPLICATIONS**

New and improved products often create unprecedented threading problems—both in design and production. Realizing this, we offer all manufacturers the help of our Thread Engineering Service in efficiently and economically solving their Thread Problems.

The difficulty may be in designing a thread which will function properly as an operating part, or in producing a thread already designed. Whatever the problem our Engineering Department is ready to help with advice and assistance—or to undertake the solution alone.

After examining all phases of the problem, the necessary recommendations will be made on basic Thread Design, the production process, and the Threading Equipment that should be used. For example, often a difficult Thread Production problem can be solved with a slight change in basic Thread Design. Occasionally, a job is so unique that special equipment is needed—three such Special Equipment Applications developed by our Engineering Department are illustrated below.

Whatever your Thread Problem, use our THREAD ENGINEERING SERVICE. Hundreds of manufacturers have been able to perform difficult threading operations efficiently and economically with Landis Threading Equipment. The years of Thread Experience and Engineering Know-How that has brought LANDIS to the fore in Thread Generating is at your service. May we help you?



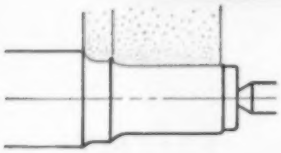
A 1½" Single LANDMACO Machine equipped with special carriage front for threading axle housings.

LANDIS Machine COMPANY
WAYNESBORO, PENNSYLVANIA

OF THREAD GENERATING *EQUIPMENT*

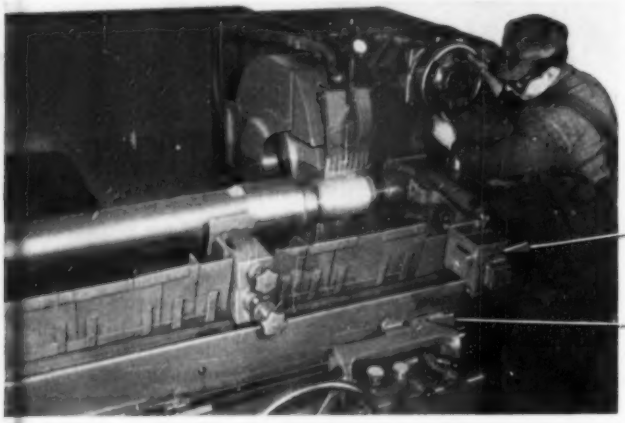
Special Tooling on Standard Type F Plain Grinder

LANDIS TOOL PUTS RAILROAD AXLE



High production

Plunge grind journal and seal diameter plus blended 1" and 1½" radii. Approximately .040" stock removed. Profile grinding wheel 12" wide for high production.

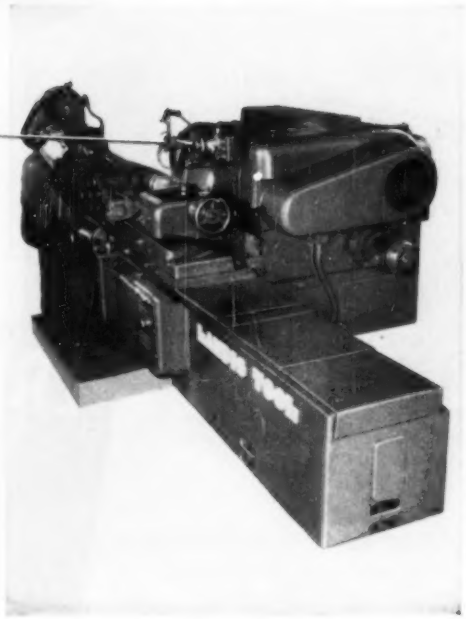


Profile wheel truing fixture control

Interchangeable profile bars

98

Electric rapid wheel head movement control and automatic grinding feed adjustment

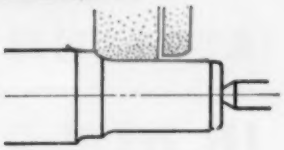


All axle grinding operations shown were done on Landis Tool Type F Plain Hydraulic Grinders. For detailed specifications, request Catalog F48. Production estimates and tooling suggestions given without obligation.

LANDIS TOOL
Precision Grinders

GRINDING on a COST REDUCTION BASIS

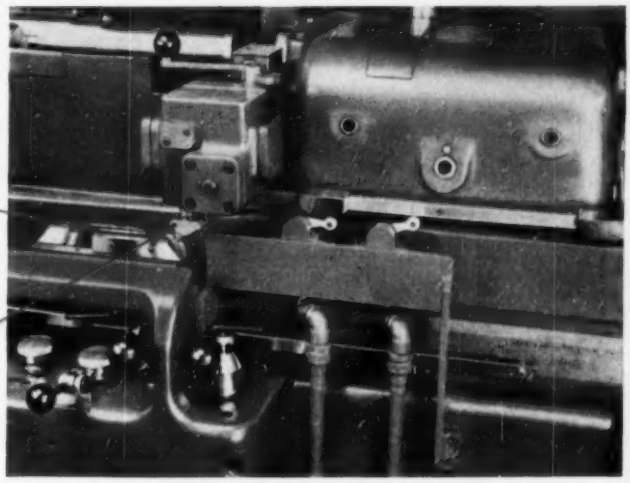
Flexible operation



Combination plunge and traverse grinding operation on journal and seal diameter plus blending radii. This permits variety of axles to be handled on one machine. Profiled grinding wheel.

Wheel dresser profile bars

Profile bar follower



Eye level wheel feed

Indicating sizing gauge

EQUIPPED WITH MICROSPHERE BEARINGS

LANDIS TOOL COMPANY / WAYNESBORO, PENNA., U. S. A.

STANDARD G. & L. MACHINE AND ATTACHMENTS PLAY *Important Part* IN NEW DIESEL ELECTRIC LOCOMOTIVE REPAIR PROGRAM

Numerous Repair Jobs Ordinarily Requiring Special Purpose Machines Now Are Handled Efficiently and Economically on a Giddings & Lewis Horizontal Boring Machine

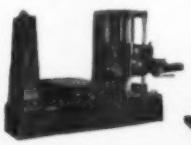
Confronted with the problem of repairing and reconditioning electric motor and diesel engine components, a large midwestern railroad uses a Giddings & Lewis machine to speed this work in its own shop. Instead of returning worn or damaged motor and engine parts to respective manufacturers for repair, thus extending locomotive out of service time, the repairs are made "on the spot" with minimum delay and handling.

Breakdowns vary to such an extent it is necessary to have a general purpose machine flexible enough to bore, drill, ream, tap, counterbore or perform any other similar machining operation. A standard G. & L. machine with standard attachments make all these operations possible. When the horizontal boring machine is not used for diesel electric locomotive repairs, it is profitably kept busy machining cross heads and axle housings, boring rods, turning flanges on odd shaped pipes, and many other operations on parts for steam locomotives.

Alignment Easily Maintained on Typical Reboring Job

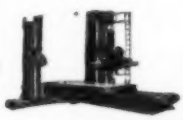
The cast steel motor housing is being rebored to receive the motor support journal bearings. When the power unit is in operation, vibration causes the housing to wear at bearing contact. As the wear increases, alignment of pinion and gear is impaired and then it becomes necessary to strip the motor housing and build up the worn surface by welding. After the fill is made, bearing caps are bolted into position and the two axles are bored simultaneously insuring accurate re-alignment. The number of repair jobs which can be machined on the G. & L. is determined largely by the imagination and ingenuity of the machine operator.

The general purpose Giddings & Lewis horizontal boring, drilling, and milling machine is well adapted to countless railroad machining jobs. G. & L. engineers will gladly advise and recommend the correct size machine and attachments for your shop, roundhouse or backshop needs.



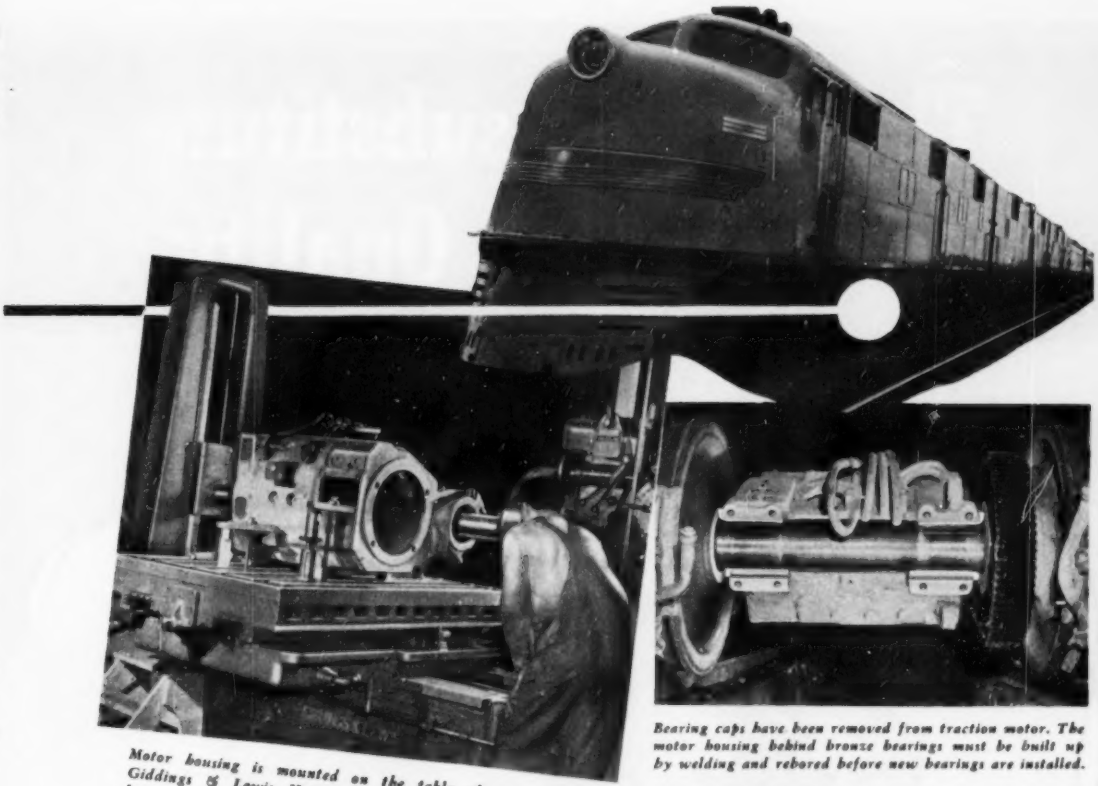
G. & L. Table Type

G. & L. Floor Type



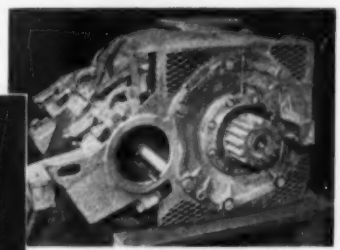
G. & L. Planer Type

GIDDINGS & LEWIS
FOND DU LAC

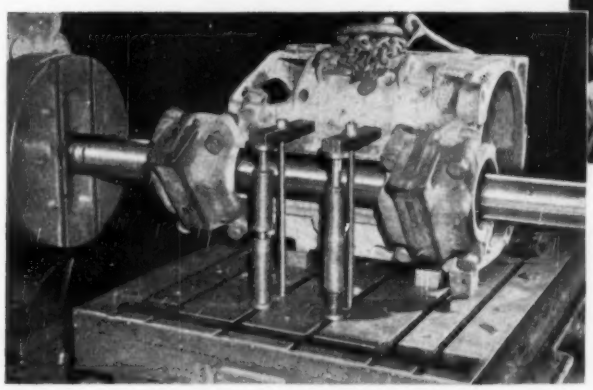


Motor housing is mounted on the table of a 350-T Giddings & Lewis Horizontal Boring Machine. Two boring cuts are made simultaneously.

Bearing caps have been removed from traction motor. The motor housing behind bronze bearings must be built up by welding and rebored before new bearings are installed.



Single traction motor unit of a gas electric motor car. Motor support bearing housings have been rebored to receive split bronze bearings.



Motor housing in the process of being rebored. Two cutters are used to speed this operation. Full support of boring bar between machine headstock and end support column insures accurate bore alignment.

Complete Information

FREE Descriptive of Giddings & Lewis machines and attachments for men interested in increasing work output. Write for this literature now—

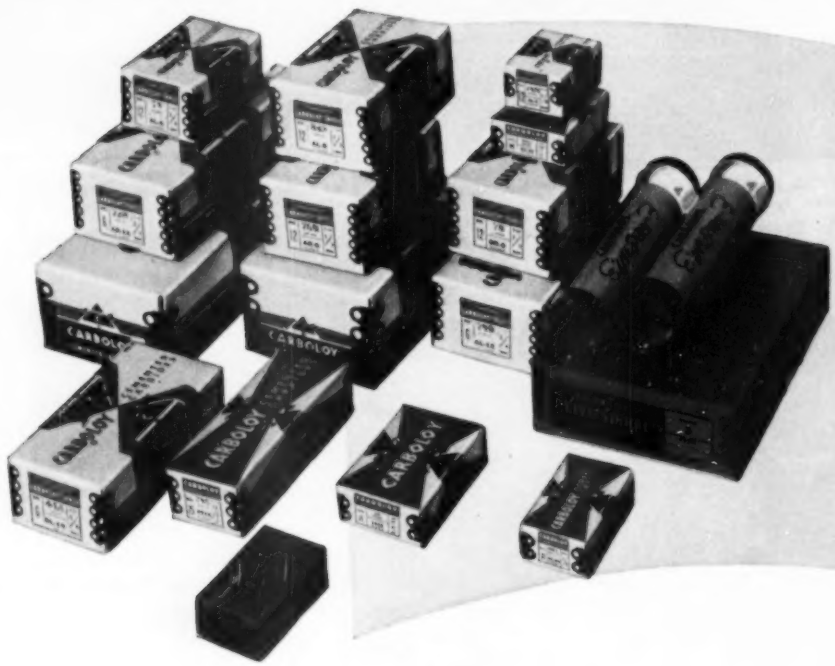
ALSO DATA STORY ON MACHINING AND REPAIRING DIESEL ENGINES.

MACHINE TOOL COMPANY

WISCONSIN U. S. A.

There is no substitute for Carboloy Quality

Consistently uniform order after order, package after package, job after job . . . no matter which Carboloy Tools or Blanks you specify.



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1 Lowest *plant-wide* average tool cost per piece machined

"Tool life has been increased from 6 to 50 times, with piece production almost doubled in many cases."

*Eastern washing machine manufacturer**

2 Highest *plant-wide* average production per machine

"With fewer machine tools in operation, production was *more than doubled*, but cost per piece was not increased . . . despite wage and material cost increases."

*Midwest manufacturer**

3 Lowest *plant-wide* average machining cost per piece machined

"On 1500 jobs tooled with Carboloy, machining costs dropped an average of 25% and machine capacity increased an average of 43%."

*Machine tool manufacturer**

4 Close *plant-wide* production control standards to which you can absolutely adhere

"Our tool and methods engineers have used predetermined time standards, but have found greatest benefits are possible only with the long life and repeated uniform performance of carbide tools."

*Large manufacturer of pumps**

CARBOLOY COMPANY, INC.

11149 E. 8 Mile Blvd., Detroit 32, Michigan

* Name on request

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The most spectacular results are obtained when Carboloy Cemented Carbides are used under Carboloy Company's unique "Triple C" Plan of Coordinated Carbide Control. It has worked wonders for others; it can do the same for you. Write today for your copy of the CCC Plan Book that explains in detail how this program operates. No cost, no obligation.

CARBOLOY®

THE UNIFORM CARBIDE

Lower Your Carbide Grinding Costs

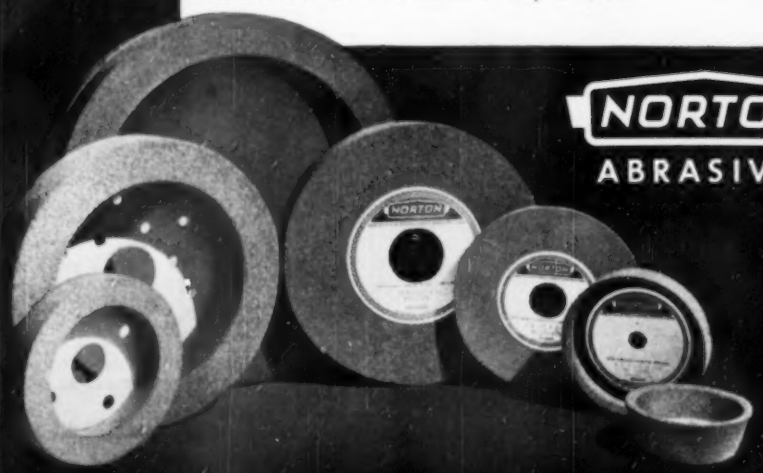
with

CRYSTOLON WHEELS *in the New K-Bond*

A faster and freer cutting action combined with greatly increased uniformity in grinding action — this is what you get with the *new Norton K-Bond*, a new vitrified bond for CRYSTOLON grinding wheels both green and gray. The high rate of stock removal and the cool cutting action of the new K-Bond speed up the grinding operation and help eliminate spoiled tools — thus they reduce the over-all grinding costs.

Also, the Norton K-Bond has brought about a new standard of uniformity to vitrified bonded silicon carbide wheels. These products can now be controlled to such a degree of accuracy as to make is possible to produce wheels of half grade increments of hardness. Thus Norton wheel specifications can be "pin-pointed" to suit the individual requirements of your carbide grinding jobs.

In plant after plant, the new K-Bond CRYSTOLON wheels are showing remarkable results. *You will want to try them, too.*



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with

DIAMOND WHEELS
in Vitrified, Resinoid, and Metal Bonds

FOR the plant that is grinding carbide tools in any appreciable quantity, diamond wheels are unquestionably the most economical because of their faster cutting action and longer life. And with Norton diamond wheels this is especially true because the *three types of bond* make it possible to supply exactly the right wheel — the most economical wheel — for each job.

Vitrified Bond — combining a fast cutting action with long life it is outstanding for sharpening single-point tools. It is also popular for chip breaker wheels ¼" or more thick.

Resinoid Bond — first choice for all fixed feed operations such as surface and cylindrical grinding and the sharpening of multi-tooth cutters; also used for thin chip breaker wheels.

Metal Bond — used for sharpening single-point tools when maximum wheel life is the first consideration; also in cut-off wheels for cutting carbide blanks.

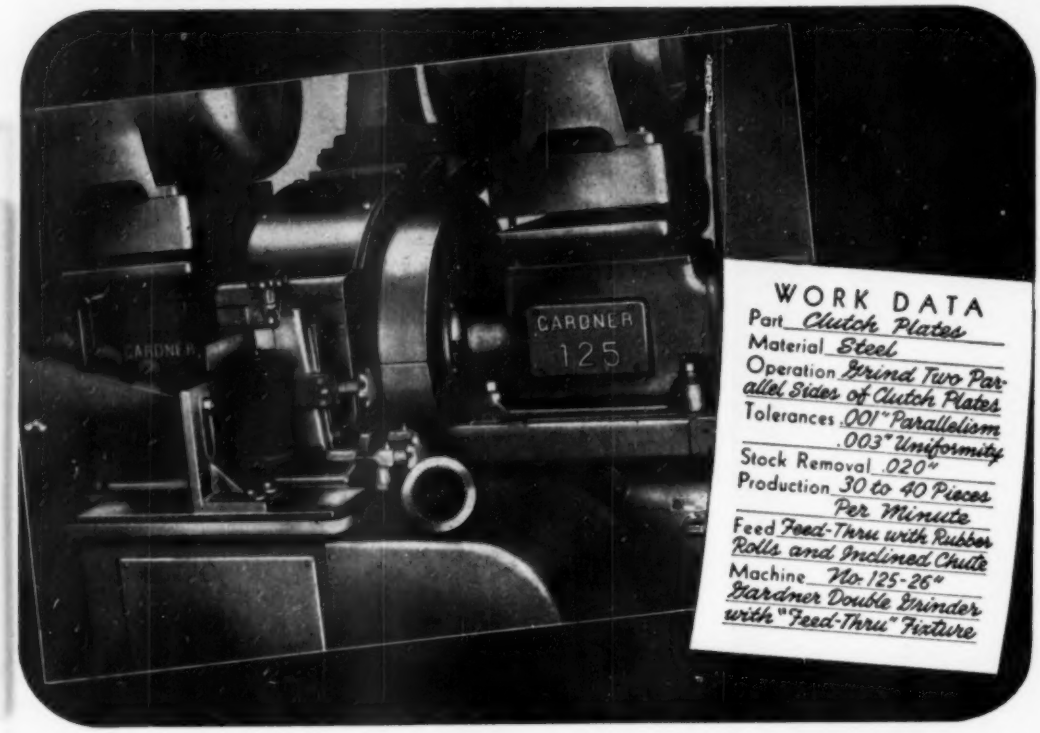
W-1301

A 140-page, newly revised handbook on carbide grinding—free on request. Ask for Form 167-A-2.

Making better products for less is the American way

Double GARDNER-GRINDING

. . . cuts production time in half



WORK DATA

Part *Clutch Plates*
Material *Steel*
Operation *Grind Two Parallel Sides of Clutch Plates*
Tolerances *.001" Parallelism*
.003" Uniformity
Stock Removal *.020"*
Production *30 to 40 Pieces Per Minute*
Feed *Feed-Thru with Rubber Rolls and Inclined Chute*
Machine *No. 125-26" Gardner Double Grinder with "Feed-Thru" Fixture*

Grinds *two* parallel sides of Clutch Plates *at once!*

GARDNER-GRIND *Your Flat Surfaces*

PARALLEL-surface grinding is the GARDNER way to cut production costs on dozens of jobs. A typical example is the automotive steel clutch plates being ground at the rate of 30 to 40 pieces per minute on the Gardner No. 125-26" Double-Grinder illustrated.

You, too, may have parallel-surface parts which can be handled on a Gardner Grinder.

Ask for our DOUBLE-GRINDING Bulletin!

GARDNER MACHINE COMPANY

410 EAST GARDNER STREET . . . . BELOIT, WISCONSIN, U.S.A.

Operators acclaim it as a money maker!

Whenever operators enthusiastically acclaim a feature as a money maker for them it automatically follows that it is likewise a money maker for the owners.

The direct reading speed control of "AMERICAN" Pacemaker Lathes is a real money maker and operators freely admit it. It makes their work easier; they can secure the right speed quicker; they produce more work because of it and, what is of paramount importance, the pay roll dollar buys more as a consequence.

The direct reading speed control unit shows at a glance the available speeds and the simple means of securing them. Imagine 27 spindle speeds being secured through only two conveniently placed direct reading levers without having to refer to index plates or having to retain lever positions in mind.

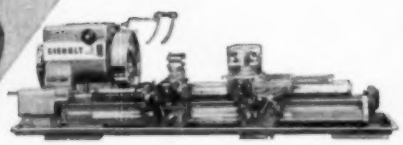
Furthermore, the simplicity of this mechanism and the infinitesimal time required to make speed changes inspire operator confidence and encourage him to make changes necessary to secure correct cutting speeds.

This and other fine features of the "AMERICAN" Pacemaker are thoroughly illustrated and described by Bulletin No. 16.

THE AMERICAN TOOL WORKS CO., Cincinnati, Ohio, U. S. A. LATHES AND RADIAL DRILLS

RUGGED POWER

Silky Smooth



GISHOLT

Saddle Type Turret Lathes

Here's how modern Gisholts are geared for greater production—to deliver smooth, vibrationless power—instantly responsive—dependable for years to come. Note these outstanding features:

1 *Gears* . . . Husky headstock gearing will carry all the horsepower and all the load of today's tools, as well as that of the foreseeable future. Rigidity is complete from the massive headstock casting right through to the ground teeth in each gear.

2 *Clutches* . . . Warner Electric Clutches inside the drive pulley do all forward and reverse driving, as well as inching and braking. They never need adjustment and give the smoothest acceleration and braking power ever put on a turret lathe. Instant HI-LO speed changes are obtained at the touch of a finger through hydraulically operated multiple disc clutches.

3 *Bearings* . . . Two precision tapered roller bearings at the front of the spindle, together with the precision ball bearing at the rear, carry all the radial and thrust load you can give them.

Why not get all the facts? A new bulletin on Gisholt 3L, 4L, 5L Saddle Type Turret Lathes is just off the press. Write for it.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin

THE GISHOLT ROUND TABLE

represents the collective experience of specialists in the machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.

TURRET LATHES • AUTOMATIC LATHES • SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

LINK-BELT
Ball and Roller Bearings are "HOUSING SEALED" Completely...

to assure free aligning action

The aligning surfaces are completely enclosed within the lubricant area of the bearing. The seals maintain their high effectiveness regardless of alignment.

to keep out dirt and moisture

The lubricated seals keep grease in and dirt and moisture out, even under extreme misalignment, contributing to longer life of bearing.

to reduce wear under most severe conditions

The exclusion of dirt and moisture and the retention of lubricant *within* the "housing sealed" area, assure minimum wear even under severe operating conditions.

Link-Belt engineers with broad experience in power transmission and bearing application will be pleased to consult with you without obligation. May we send you Data Book No. 2550 containing full engineering information?

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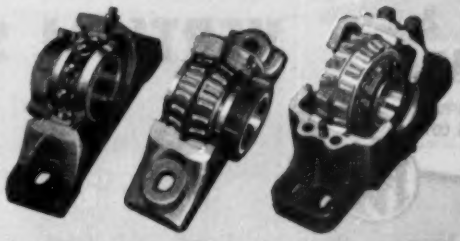
11,700

A complete line of bearings is available from stock, throughout the country, in pillow blocks, cartridge, flanged cartridge, flanged, hanger and takeup blocks —also unmounted bearings.



LINK-BELT
BALL & ROLLER
BEARINGS

Almost any job is...

EASY TO MOUNT

EASY TO INDEX

EASY TO OBSERVE

EASY TO CONTROL

Use it in the toolroom for any kind of fixture, jig or tool work. Vertical design makes it easier for cutting tool to get at hard-to-reach surfaces and machine intricate shapes, odd bosses and slots. Built-in rotary table gives accurate indexing.

Use it in the die shop to machine any shape *to a line*. Ram adjusts to angular setting for machining relief angles directly.

They call it "the handiest machine in the shop" because of its adaptability, general usefulness, and maximum productivity.

Bulletin lists all advantages; send for your copy.

—on this "The Handiest Machine in the Shop"

THE PRATT & WHITNEY VERTICAL SHAPER

PRATT & WHITNEY

Division Niles-Bement-Pond Company

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IBM gets speedy, precision cleaning of 50,000 different parts . . . with

VAPOR DEGREASING

Courtesy: International Business Machines Corporation, Endicott, N. Y.

Fifteen years ago, the International Business Machines Corporation installed its first vapor degreasing unit in the main plant at Endicott, New York. This modern metal cleaning method, using trichlorethylene, replaced the hand wiping of flat stock and the use of the alkaline dip for the removal of oil and grease.

So successful was this first unit that, today, there are five degreasers in the Endicott plant being used for the thorough cleaning of over 50,000 different parts for the more than 1000 models of IBM business machines, time-recording units, and indicating and signaling devices.

IBM has found that vapor degreasing quickly and easily removes oil, grease and dirt from recesses and holes in even the most intricate precision parts. And the degreasers are used to handle all types of work—from tiny screws and studs to large iron castings—prior to finishing, inspection and assembly. High IBM precision standards are safely met by this precision-like cleaning method.

The excellent results experienced at the Endicott plant of IBM are being duplicated daily in thousands of plants across the country. Perhaps vapor degreasing can mean important economies in time and cost for you. Why not investigate its possibilities today?

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Under various trade marks, Du Pont degreasing solvents have been widely used for many years. These solvents are stable . . . the best yet developed by Du Pont for metal degreasing. They stand up against contaminating and destructive materials which may be introduced in degreasing . . . assist materially in carrying out efficient cleaning.

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for VAPOR DEGREASING
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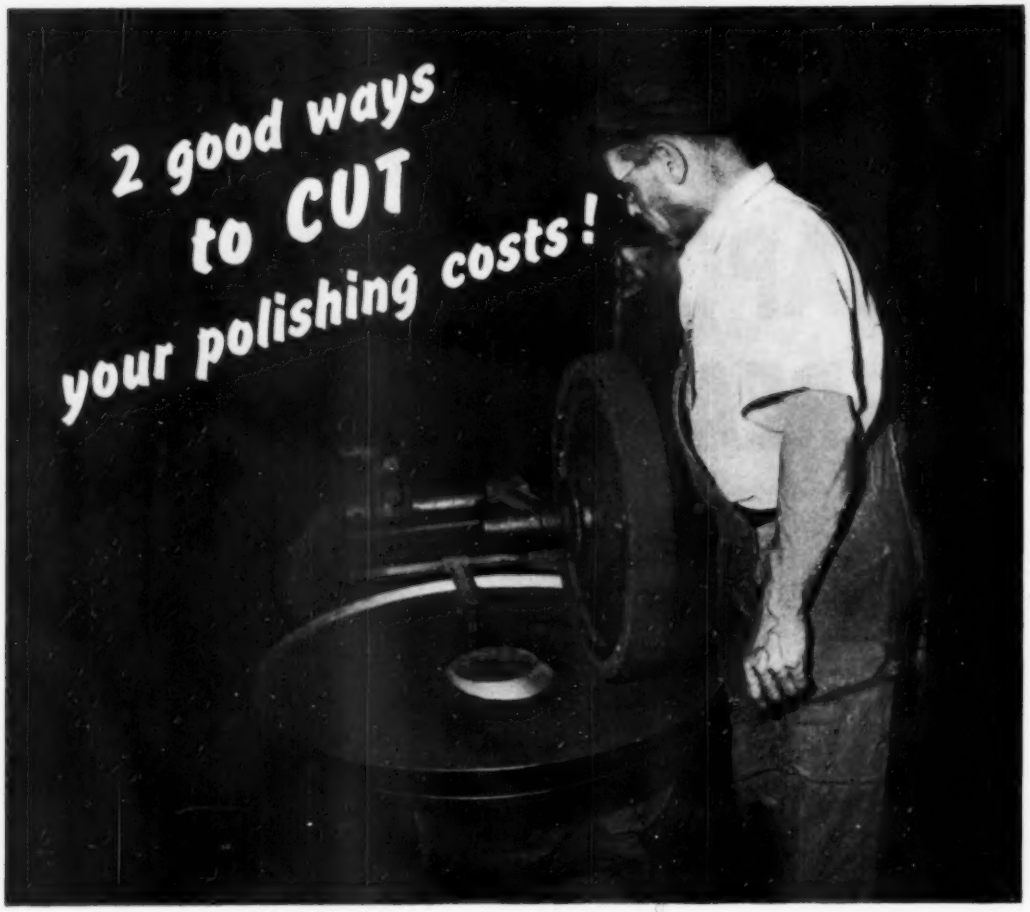

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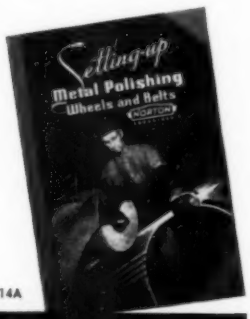
(2) Take advantage of the many helpful tips on polishing and setting-up metal polishing wheels and belts offered in this interesting 44-page Norton booklet. Send for your free copy—no obligation of course.

This illustration of a glued wheel being rolled automatically is typical of the many helpful pictures shown in the booklet described below.



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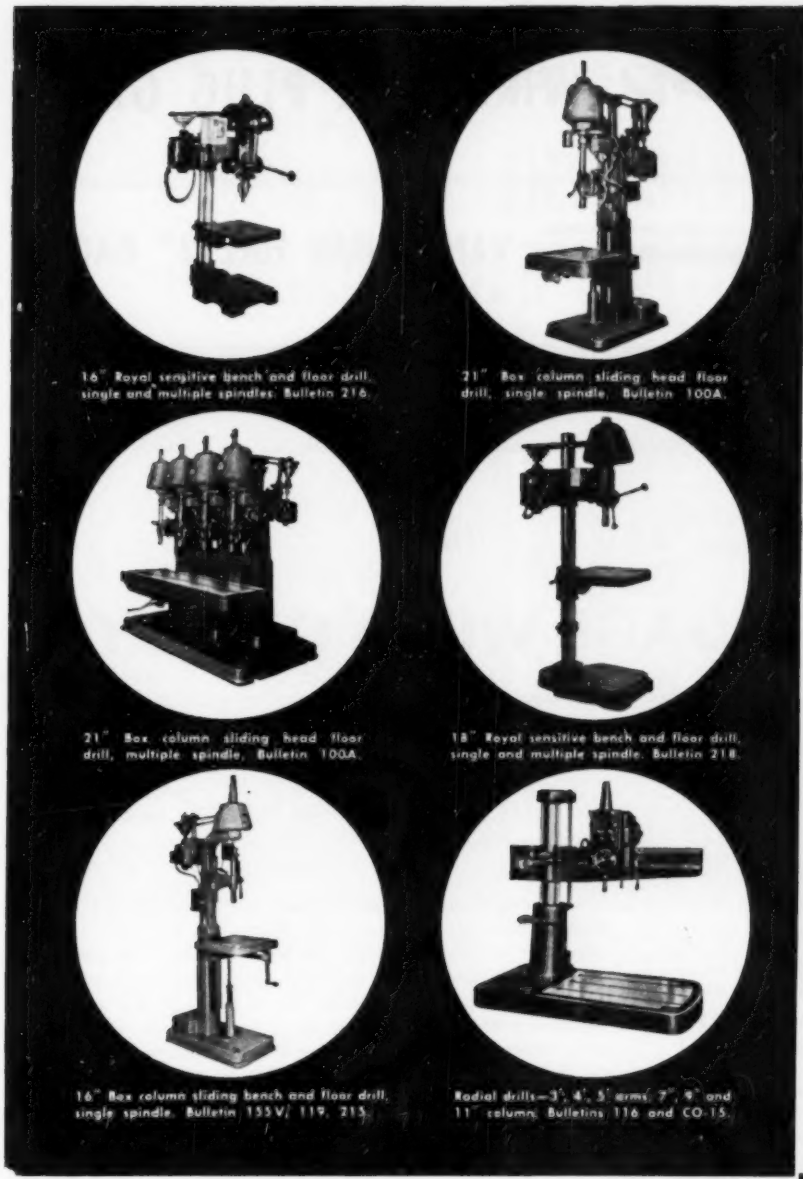

16" Royal sensitive bench and floor drill, single and multiple spindles. Bulletin 216.

21" Box column sliding head floor drill, single spindle. Bulletin 100A.

21" Box column sliding head floor drill, multiple spindle. Bulletin 100A.

18" Royal sensitive bench and floor drill, single and multiple spindle. Bulletin 218.

16" Box column sliding bench and floor drill, single spindle. Bulletin 155V, 119, 215.

Radial drills—3', 4', 5' arms, 7", 9" and 11" column. Bulletins 116 and CO-15.

how to drill an argument full of holes

The familiar "we can't afford it" argument will very likely go to pieces when matched against high money saving productivity and low initial cost in the Canedy-Otto Cincinnati line of light, upright, sensitive and radial drilling machines. They offer the sizes, types, speeds, feeds and adaptability to fit better than 90% of your drilling requirements... The Canedy-Otto line is now backed by a leading name in lathe manufacture. Write for latest literature.

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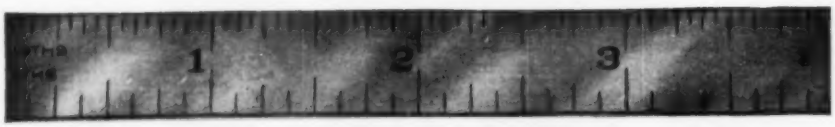
Van Keuren WIRE TYPE PLUG GAGES

VAN KEUREN FULL 2" GAGE



AGD 1¼" GAGE

WHICH GAGE WILL YOU BUY?

CATALOG AND HANDBOOK No. 34

This 208 page volume represents 2 years of research sponsored by the Van Keuren Co. It presents for the first time in history a simple and exact method of measuring screws and worms with wires.

It tells how to measure gears, splines and involute serrations. It is an accepted reference book for measuring problems and methods.

Copies are now free upon request.

Wire Type Plug Gages were originated by The Van Keuren Co. over 25 years ago. In 1948 this design was adopted in shorter lengths as the AGD standard for gaging holes from .030" to .510" diameter. The Van Keuren Co., because of years of pioneering, is able to offer the extra length at little or no extra cost.

You cannot afford to lose this extra length. When you need plug gages obtain a quotation from The Van Keuren Co.—Compare COST PER HOLE GAGED. You can be assured of quality and accuracy. A double inspection at the factory eliminates your inspection expense. No time will be lost waiting for replacements. You can count on prompt delivery from a stock of 2 million wires. Specify Van Keuren wire type gages and get the most GAGE for your GAGE DOLLAR.

Send for Supplement 19 showing quick and easy method of getting 4 to 10 gages from 1 VK wire type gage unit.

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CHROMIUM PLATE **VK CARBOLOY**

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THE Van Keuren CO., 173 WALTHAM STREET, WATERTOWN, MASS.

31st YEAR

Light Wave Equipment • Light Wave Micrometers • Gage Blocks • Taper Insert Plug Gages • Wire Type Plug Gages • Measuring Wires • Thread Measuring Wires • Gear Measuring System • Shop Triangles • Carboloy Plug Gages • Carboloy Measuring Wires

Looking for savings?

NOW, GET TIME-SAVING MONO-LEVER CONTROL ON NEW 3hp MILLING MACHINES

You asked for them — here's one in action — a new 3hp Kearney & Trecker Milling Machine with Mono-Lever Control and Automatic Table Cycle. Savings on this simple form-milling job amounted to 28%!

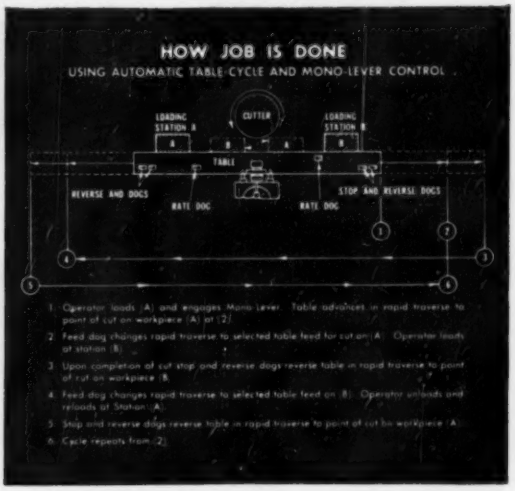

HOW JOB IS DONE
USING AUTOMATIC TABLE CYCLE AND MONO-LEVER CONTROL
LOADING STATION A
CUTTER
LOADING STATION B
TABLE
REVERSE AND DOGS
RATE DOG
RATE DOG
STOP AND REVERSE DOGS
1. Operator loads (A) and engages Mono-Lever. Table advances in rapid traverse to point of cut on workpiece (A) at (2).
2. Feed dog changes rapid traverse to selected table feed for cut on (A). Operator loads at station (B).
3. Upon completion of cut stop and reverse dogs reverse table in rapid traverse to point of cut on workpiece (B).
4. Feed dog changes rapid traverse to selected table feed on (B). Operator unloads and reloads at Station (A).
5. Stop and reverse dogs reverse table in rapid traverse to point of cut on workpiece (A).
6. Cycle repeats from (2).

Diagram shows how operator set up table for automatic reciprocal milling operation. He engaged the Mono-Lever once for entire run. Machine required no further attention other than loading workpieces.

COMPARE

Production by old method.

28%

Production gain using a Kearney & Trecker Milling Machine with Mono-Lever Control and Automatic Table Cycle.

HERE'S GRAPHIC PROOF OF SAVINGS RESULTS

16% | 16%-49% | 49%-96%

1 2 3

1. The minimum over-all savings reported from any job when done on a Kearney & Trecker Milling Machine with Mono-Lever Control and Automatic Table Cycle.
2. The *majority* of over-all savings from jobs done on these machines fall here.
3. Under favorable conditions, several jobs done on these machines have shown savings like this!

YES, you can now get the proven cost-cutting benefits of Mono-Lever Control and Automatic Table cycle on 4 new 3hp Kearney & Trecker knee-type milling machines.

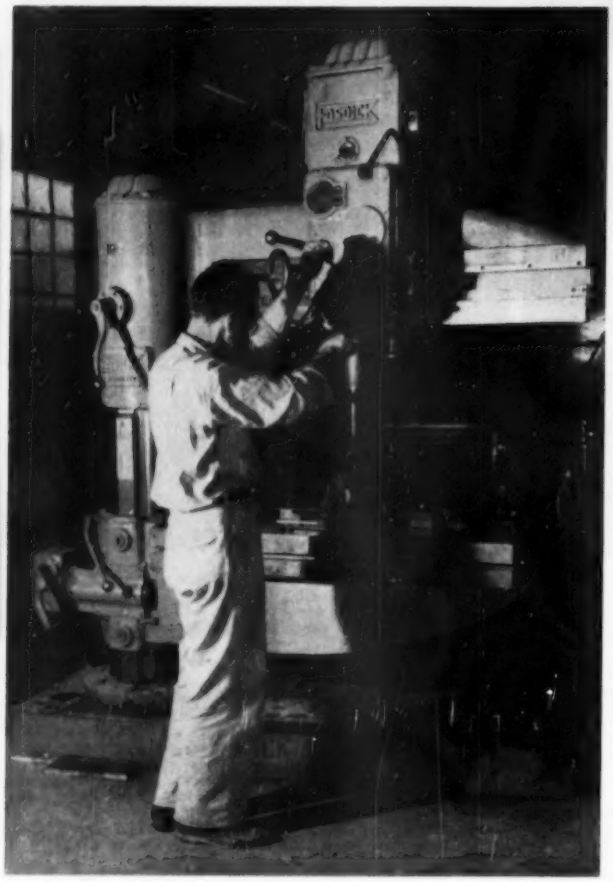
Exhaustive job tests have shown that savings made possible by Mono-Lever Control and Automatic Table Cycle on larger machines — *are equally available on these new 3hp machines.* That means savings to you of *16% to 96% on most milling operations*!

Contact our nearest representative today. Get the facts on how new Kearney & Trecker Milling Machines with Mono-Lever Control and Automatic Table Cycle return new savings to you. Kearney & Trecker Corp., 6784 W. National Ave., Milwaukee 14, Wis.

KEARNEY & TRECKER MILWAUKEE MACHINE TOOLS

Fills a void in Sensitive Production

FOSDICK Sensitive RADIAL



The installation above was taken in the plant of Vernon Kilus, Los Angeles, California.

● In industrial centers from Maine to California and from Michigan to Texas you'll find FOSDICK Sensitive RADIALS in operation.

The practical utility of this new Fosdick machine for handling sensitive drilling operations has given it a wide acceptance in a period of less than two years.

The sturdy one piece column, the arm at fixed height, the table adjustable on the column and the conventional base are features that add to its versatility. For example, both the arm and the table swing in an arc of 360°.

Note also that the operator from a normal operating position can easily feed the tool into the work or throw in power feed when desired. To provide a more convenient means of hand feeding the spindle a ratchet handle is provided.

Spindle speeds as low as 60 R.P.M. and as high as 3600 R.P.M. are available and four feeds are obtained through a direct reading lever on the right hand side of the head.

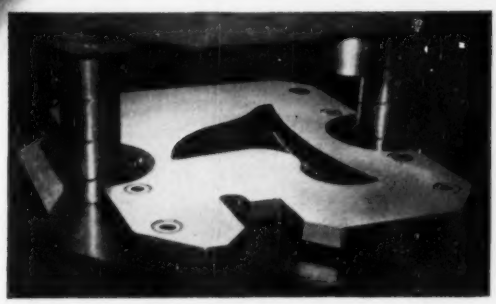
If you need a truly versatile machine for handling your sensitive operations investigate the FOSDICK Sensitive RADIAL.

Full descriptive bulletin available—write for Fosdick Sensitive Radial Bulletin S R A.

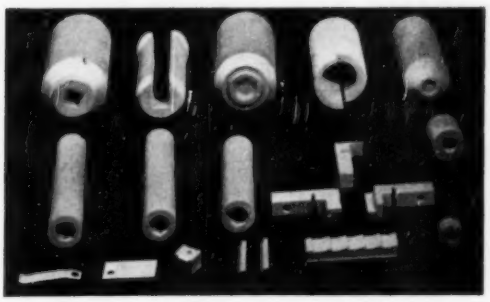
FOSDICK MACHINE TOOL *Company*
CINCINNATI 23, OHIO

MANUFACTURING PLANTS · MACHINE SHOPS
SHIPYARDS · FORGE SHOPS · ROLLING MILLS
MINES · FOUNDRIES · FABRICATING WORKS

This tool steel proving ground means better tool performance



This blanking die is made from Lehigh H, our popular high-carbon, high-chrome steel for long production runs. Made in one of our own tool-rooms, this die produces parts from $\frac{3}{16}$-in. steel plate for our weldment shop at the Bethlehem, Pa., plant.



These automatic bolt-header parts are typical of the many uses at our Lebanon, Pa., plant for our carbon tool steel (cold-heading quality) and Bethlehem hot-work and shock-resisting steels.

We are makers of tool steel, and large users as well. We use hundreds of tons of Bethlehem Tool Steels every year. Tools and dies, made from dozens of our different grades, are put to work on production jobs in Bethlehem shipyards, mines, machine shops, foundries, forge shops, rolling mills, fabricating works and manufacturing plants.

Knowing exactly how to treat and apply a tool is often just as important as the inherent quality of the tool steel. By making full use of our tremendous proving grounds we've learned a whale of a lot about tool steel. On one job, for example, we may match three grades against each other. In another case we may try several different heat-treatments on one steel in order to achieve the best properties for a shear blade, a tool bit, or a punch. Improved grades of tool steel are often the direct result of long observance of tool performance in our own shops.

By putting tool steels to work among our own family, we gather reliable facts with which to supplement the findings of our laboratories. All of this leads to finding better ways to heat-treat tools, improved techniques in forging, machining, grinding. We pass along this information to users of Bethlehem tool steel—just one of many benefits that result. It's a continuous development program—unmatched in its scope!

Bethlehem makes all tool steels. In our modern mill depot we stock 23 grades of standard and special-purpose steels for quick delivery to our distributors and mill customers.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. Export Distributor: Bethlehem Steel Export Corporation.

Bethlehem ULTRASONIC TESTED **Tool Steel**

"HEAD AND SHOULDERS" ABOVE THEM ALL!

UNBRAKO Socket Head Shoulder Screws with *Knurled* Heads . . . are preferred by die-makers everywhere . . . but are useful for many machine applications. Their knurled heads provide a slip-proof grip—even if fingers and heads are oily or greasy—thus materially speeding production.

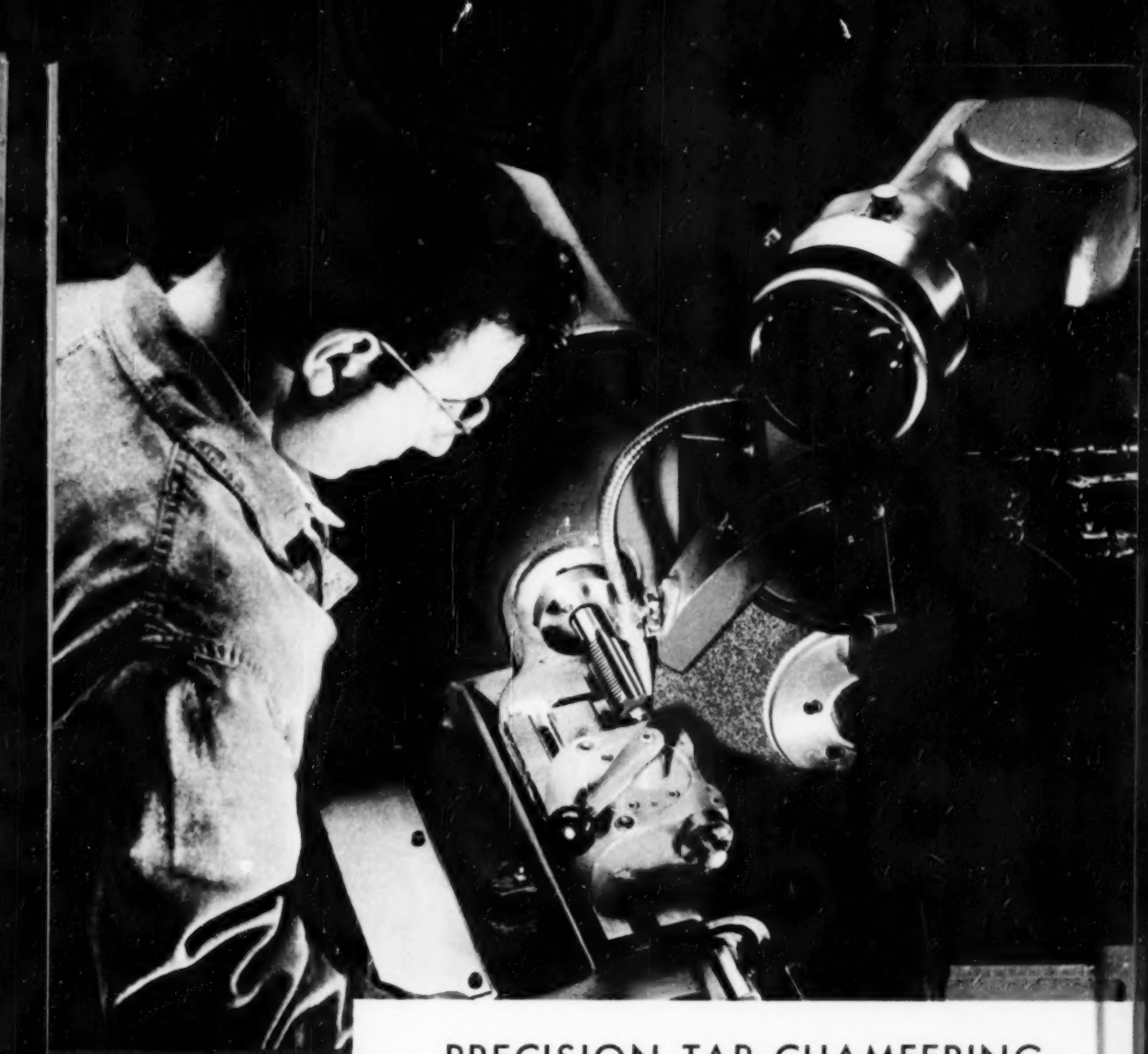
UNBRAKO Shoulder Screws are available in full range of standard sizes—other sizes to special order.

Write for further details, today.

Knurled Head Socket Cap Screws
Flat Head Socket Cap Screws
Self-Locking Socket Set Screws
Knurled Head Shoulder Screws
Precision-Ground Dowel Pins
Fully-Formed Pressure Plugs

SPS STANDARD PRESSED STEEL CO.

JENKINTOWN 1, PENNSYLVANIA



PRECISION TAP CHAMFERING

NEW, AUTOMATIC, SCIENTIFIC

Chamfer is a mighty important feature of a Tap. Concentricity, angle and length all are vital, —excessive variance in any one of these elements can start trouble that may ruin the Tap or, worse still, the product being tapped.

You can have confidence in "Greenfield" Taps chamfered on these specially designed chamfering machines which are producing chamfers to previously unheard of perfection.

BUY TAPS WITH *CONFIDENCE*

BUY *GREENFIELD* TAPS

GREENFIELD TAP AND DIE CORPORATION

GREENFIELD, MASSACHUSETTS

Geometric Rotary Die Heads

FOR LIVE SPINDLE MACHINES

KD
General Purpose Heavy Duty Head in 7 sizes, threads 1/16 to 2 1/4

KDS
Five Chaser Type for square, flat and irregularly shaped stock 2 sizes, threads 1/8 to 1

KT
For conventional or reverse taper pipe threading 3 styles, 3 sizes, threads 1/8 to 1 pipe

CK
For light duty fine pitch threading 5 sizes, threads 7/16 to 3 1/4

Simple, compact, rugged, positive in action, these rotary die heads are built for a life time of trouble free operation.

They are indeed fitting companions to the world famed "D" line of GEOMETRIC stationary die heads.

WRITE FOR LATEST BULLETIN K

BE SURE Buy GEOMETRIC

GEOMETRIC TOOL COMPANY DIVISION

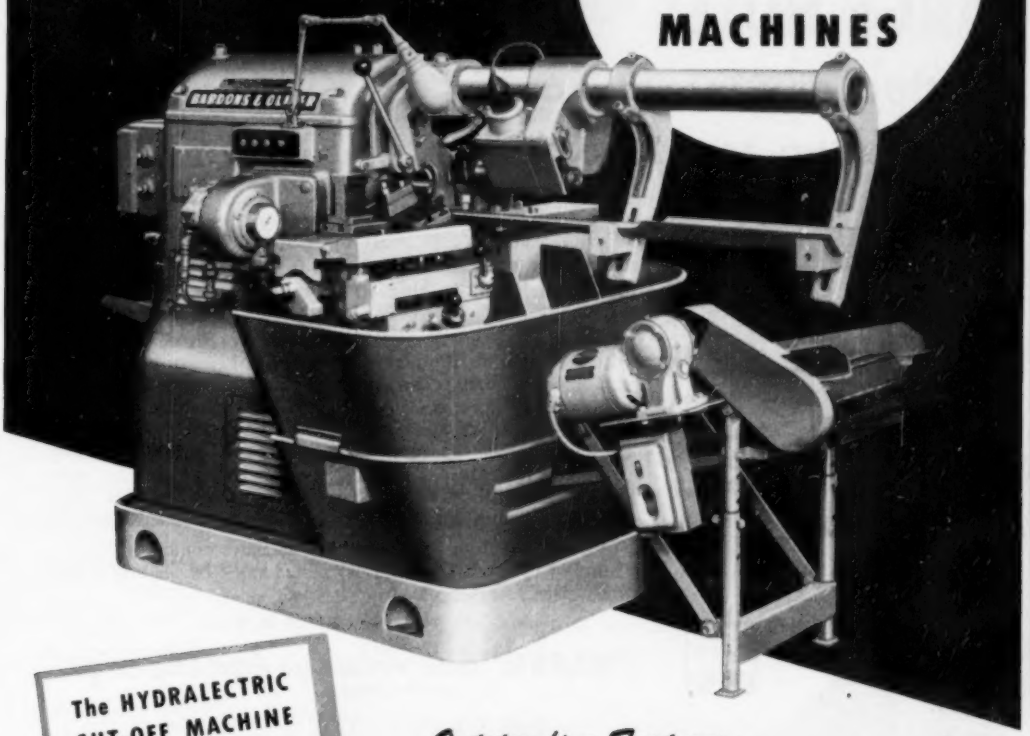
GREENFIELD TAP AND DIE CORPORATION

NEW HAVEN 15, CONNECTICUT

Motor Driven Chip Conveyor

INCREASES PRODUCTION ON..

BARDONS & OLIVER HYDRALECTRIC CUT-OFF MACHINES



The HYDRALECTRIC CUT-OFF MACHINE is built in four sizes:

No. 33. Capacity 3"
No. 34. Capacity 4"
No. 35. Capacity 5½"
No. 36. Capacity 6⅝"

Outstanding Features:-

1. No down time or production loss for cleaning out chips or butt ends. The conveyor drops them in a tote pan.
2. By means of a trough the work is automatically separated from the chips.
3. Time saved makes it easy for the operator to attend two or more machines. They are fully automatic.

Please write to us for further information.

WE ALSO BUILD A COMPLETE LINE OF RAM AND SADDLE TYPE TURRET LATHES

BARDONS & OLIVER, INC.

1133 WEST 9TH STREET • CLEVELAND 13, OHIO

Cut...

LARGE HOLES

. . . thru any machineable material up to 1⅛ *INCHES* thick!

Here is a premium tool which makes it possible to saw holes in one short operation . . . large holes which heretofore had to be laboriously machined "a-chip-at-a-time."

MARVEL High-Speed-Edge Hole Saws have strength to withstand the terrific peripheral strains of heavy duty operation in lathes, drill presses or portable power tools. They have a high speed steel cutting edge which is electrically welded to a tough, alloy steel body, high speed steel pilot drills, heavy hexagonal shanked arbors and sufficient set for deep drilling. They are self-aligning, as the larger diameter saws float on their arbors and are driven by double drive pins. They will saw round holes accurately in any machineable material.

MARVEL High Speed-Edge Hole Saws come in 35 sizes, from ¾" to 4½". They are carried in stock by leading industrial distributors.

WRITE FOR BULLETIN ST-49

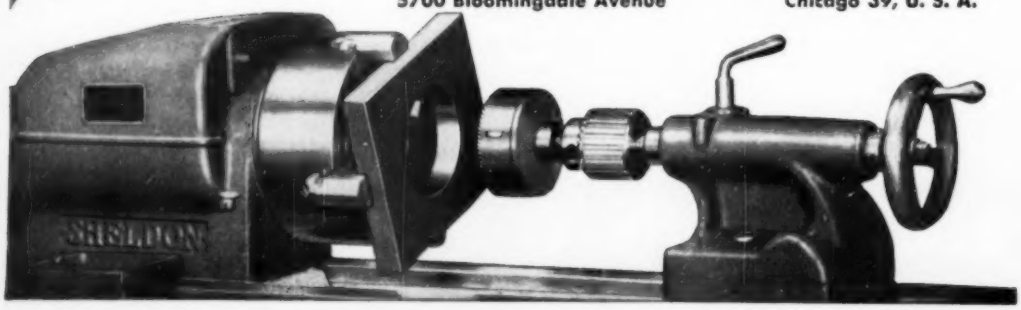
"MARVEL" ***has Always had the edge!***

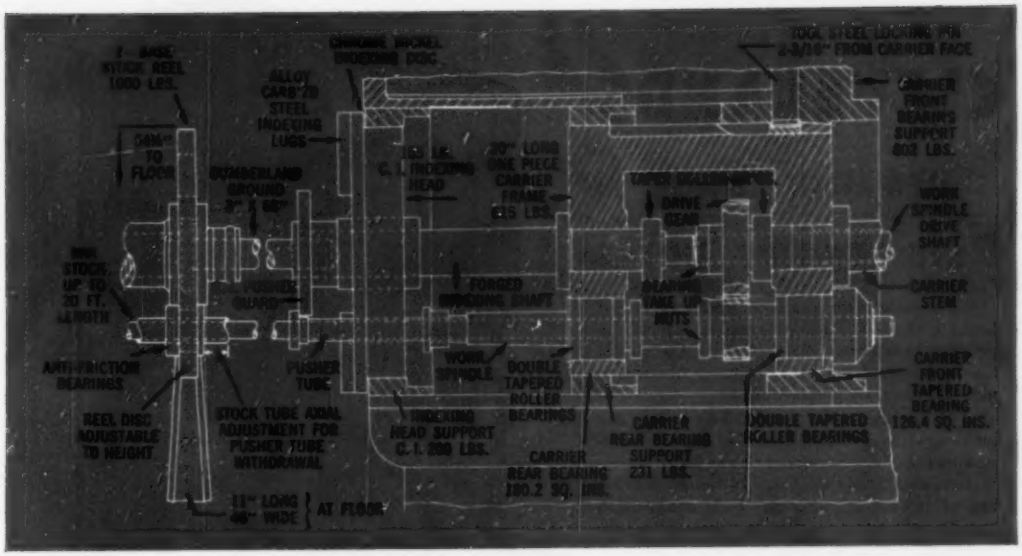
MARVEL *Metal Cutting* **SAWS**

ARMSTRONG-BLUM MFG. CO.

"The Hack Saw People"

5700 Bloomingdale Avenue **Chicago 39, U. S. A.**




ALLOY CARB'ZD STEEL INDEXING LUGS
54" TO FLOOR
BUMBERLAND GROUND
20" LONG ONE PIECE CARRIER FRAME 615 LBS.
DRIVE GEAR
WORM SPINDLE DRIVE SHAFT
CARRIER STEM
FORGED INDEXING SHAFT
BEARING TAKE UP NUTS
ANTI-FRICTION BEARINGS
PUSHER TUBE
WORM SPINDLE
DOUBLE TAPERED ROLLER BEARINGS
CARRIER FRONT TAPERED BEARING 126.4 SQ. INS.
REEL DISC ADJUSTABLE TO HEIGHT
STOCK TUBE AXIAL ADJUSTMENT FOR PUSHER TUBE WITHDRAWAL
INDEXING HEAD SUPPORT C. I. 220 LBS.
CARRIER REAR BEARING 130.2 SQ. INS.
CARRIER REAR BEARING SUPPORT 231 LBS.
DOUBLE TAPERED ROLLER BEARINGS
11" LONG 46" WIDE
AT FLOOR

FIRST THINGS COME FIRST

Upon the Spindle Carrier of an "Automatic" falls the responsibility of accurately presenting and holding the work to — and in contact with — the tools. The basic design of the Carrier is obviously of first importance in the protection of the work spindles from the strain of heavy cuts and weight of the bar stock. Then, in proportion to the Carrier's ability to handle the full load is the importance of any supplementary facility that shares the load.

1. **The 1½" Six Spindle CONOMATIC CARRIER gives better support to the work spindles under heavy loads.**

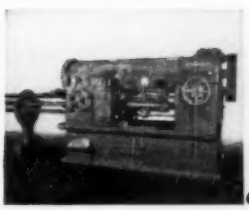
The thick, heavy ribs resist strain. The tapered front bearing and the spindle drive gears are within 3" and 9¼", respectively, of the collet faces. The wider spaced bearings give better alignment and load distribution. The Carrier is free of Cross Slide positive stop pressure.

2. **The entire INDEXING MECHANISM is supported by the Top Bed as well as the Base. There are fewer wearing parts.**

The Indexing Head takes the brunt of the indexing load. It is supported by the short frame member midway between the Carrier and the Stock Reel. It is joined to the latter by strong center shafts.

3. **The STOCK REEL is designed to handle longer and heavier loads.**

The two Stock Reel Bases are independent of the machine and relieve it of the heaviest part of the bar load during the cutting and indexing movements. Adjustable alignment gives freer stock-feed action.



Buyer's Comparison Chart will guide you to full information

A Comparison of ALL Automatics is in Favor of Cone

Conomatic

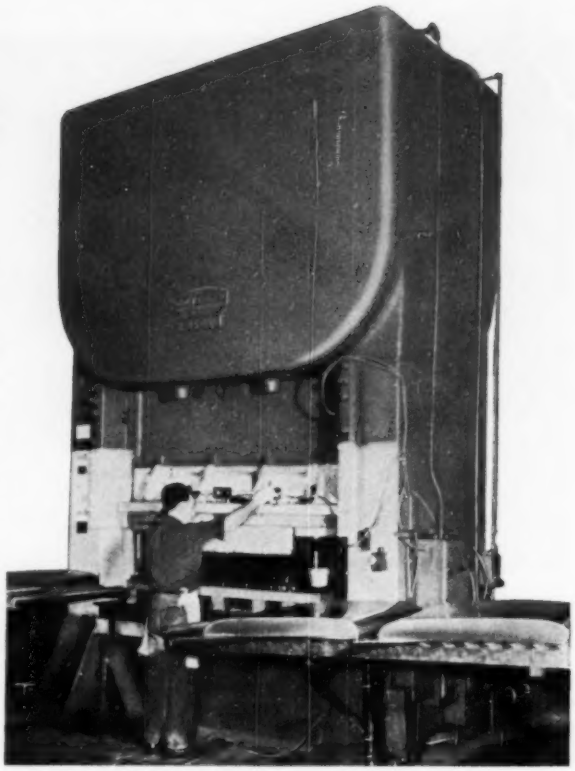
CONE AUTOMATIC MACHINE COMPANY, INC.
WINDSOR, VT., U.S.A.

CLEVELANDS
produce many
Refrigerator parts

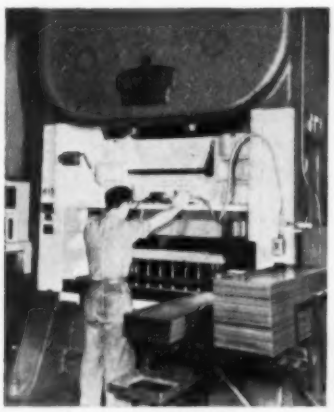
At the main plant of a large appliance manufacturer, thousands of refrigerators roll off the production line daily. As shown here, Clevelands handle many of the metal forming operations necessary in their production.

In comparison, your product may or may not be as famous as this refrigerator—your production line may not necessarily be as large; nevertheless, equipment efficiency and dependability are of utmost importance. With competition steadily increasing there must always be a concerted drive toward lower production costs.

Inspect your present Press equipment! Take advantage of the many design improvements that have been incorporated in all Cleveland Presses for greater Press efficiency. Their trouble-free operation, rigid construction and the exact control provided by the patented Cleveland Drum Type Clutch will give you lower production costs and longer die life. A-3941



Pierce and trim—main outer door.



1st Draw—upper front panel.

Trim and redraw—freezer compartment cover.

1st Draw—top outer door.

THE CLEVELAND PUNCH & SHEAR WORKS CO. U.S.A.

PUNCHING TOOLS & DIES

OFFICES AT:
NEW YORK . . . CHICAGO
DETROIT . . . . PHILADELPHIA
PITTSBURGH

Established 1880

• • • • • • POWER PRESSES • • • • • •

FABRICATING TOOLS

CLEVELAND 14, OHIO

High Hat

Two ex G.I. s had dreamed up a slick design for a portable chain saw. It was lighter and stronger than other saws because it used magnesium castings. When it came to raising capital, money men gave them the high hat . . . said "we don't know enough about magnesium". They came to light-metal headquarters, Aluminum Company of America, to get the facts. They found that hundreds of manufacturers now use magnesium. (Over a million pounds every month.) Simple shop practices make handling magnesium easy.* Books on designing and fabricating magnesium gave them the know-how they needed. Their better chain saw is now in production, backed by the same bankers who first turned them down. One of Alcoa's modern foundries supplies the castings at very attractive prices. Machining and assembly are duck soup. Sales are already cutting competitors down to size.

No change in insurance rates.

These two, free books on magnesium and our broad technical experience can help your products, too. Write Aluminum Company of America, 2106S Gulf Bldg., Pittsburgh 19, Penna. Sales offices in principal cities.

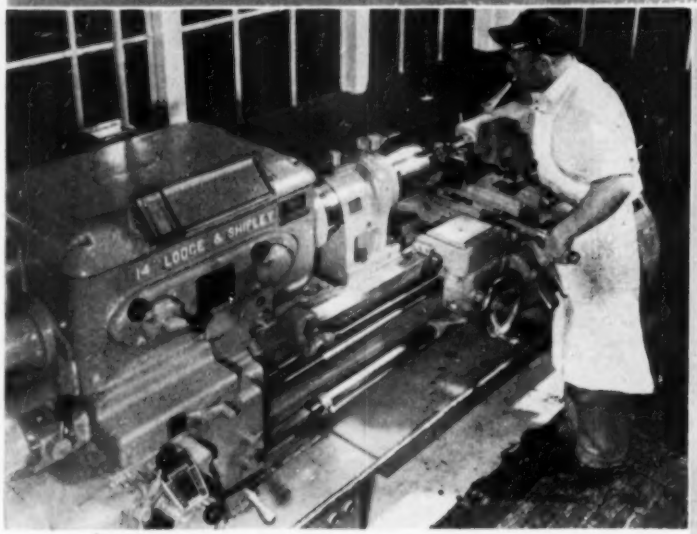
ALCOA

ALUMINUM and MAGNESIUM

Lodge and Shipley

UNIVERSAL RELIEVING ATTACHMENT

...puts Model "X" Lathes at the top of the list



for

- ☑ *Design*
- ☑ *Accessibility*
- ☑ *Operating Convenience*

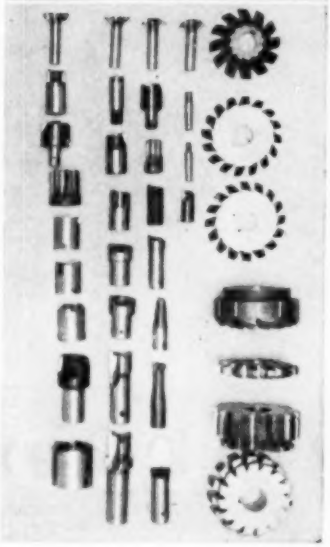
at Caterpillar Tractor Co. San Leandro, Calif.

According to the San Leandro plant of Caterpillar Tractor Co., "one feature which made us select the Lodge & Shipley Model "X" Toolmaker Lathe was the universal relieving attachment and spindle nose speed reducer," used on most of the work illustrated.

The Model "X" Lathe relieving attachment is truly universal and will perform internal and external, right hand and left hand, plain angular and end as well as spiral relieving. It becomes an integral part of the lathe for which it is supplied, does not interfere with the use of the machine for ordinary work and can be engaged or disengaged in a moment.

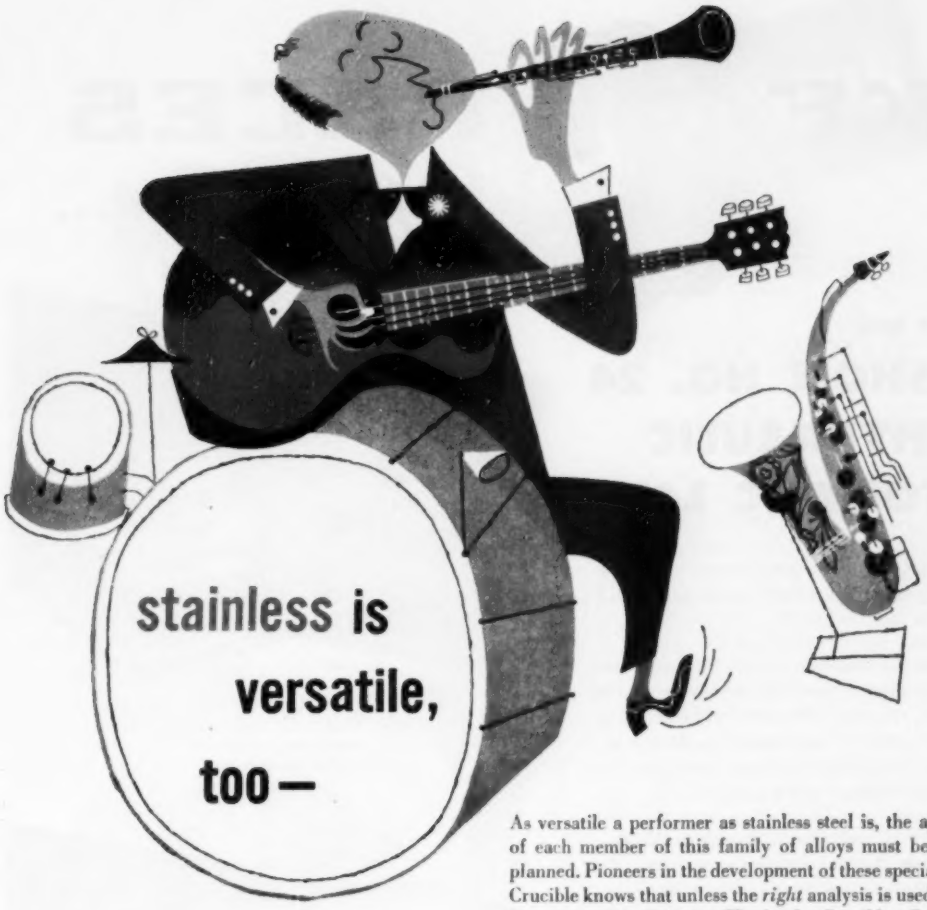
The special tools illustrated and many others are machined with the universal relieving attachment in the San Leandro plant of this noted tractor company. Among them are tools for milling, radius forming, facing, chamfering, boring, grooving, fluting and recessing.

For tool room use as well as general lathe work, Model "X" Lathes offer many advantages. A Lodge & Shipley representative will be glad to explain and demonstrate, on your own work, how this most modern of all lathes can be profitable for you. Write for your copy of Catalog 657.



THE **Lodge & Shipley** COMPANY

MACHINE TOOL DIVISION • 3055 COLERAIN
CHOREMASTER DIVISION • 800 EVANS ST.
CINCINNATI 25, OHIO



As versatile a performer as stainless steel is, the application of each member of this family of alloys must be carefully planned. Pioneers in the development of these specialty steels, Crucible knows that unless the *right* analysis is used, stainless may prove disappointing. That's why Crucible offers you the services of an alert staff of metallurgists and engineers to help you apply stainless . . . properly. These engineers and metallurgists have all the wealth of experience that Crucible's half century of specialty steel leadership provides . . . take full advantage of it.

Whatever your stainless application may be, Crucible is prepared to help you. Whether the order is in pounds or tons, Crucible tackles every industry-posed problem with a keen devotion to detail. If you're thinking of stainless . . . call in Crucible. CRUCIBLE STEEL COMPANY OF AMERICA, Chrysler Building, New York 17, N. Y.

CRUCIBLE

first name in special purpose steels

STAINLESS STEELS

fifty years of Fine *steelmaking*

STAINLESS • HIGH SPEED • TOOL • ALLOY • MACHINERY • SPECIAL PURPOSE STEELS

SKF RACES *Against Time...*

with the new

GISHOLT NO. 24 HYDRAULIC AUTOMATIC LATHE

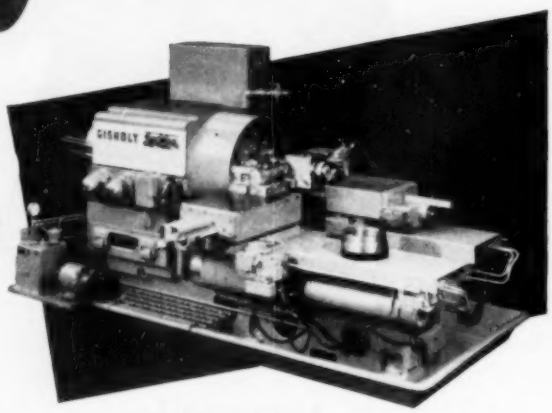
When it comes to fast production of top quality spherical roller bearing races, SKF doesn't fool.

These new Gisholt No. 24 Hydraulics remove 34 lbs. of metal in two operations in a total of only 2.80 minutes' machining time on each of two machines. All cutting is on 52100 bearing steel and done at speeds of 325 to 350 f.p.m.

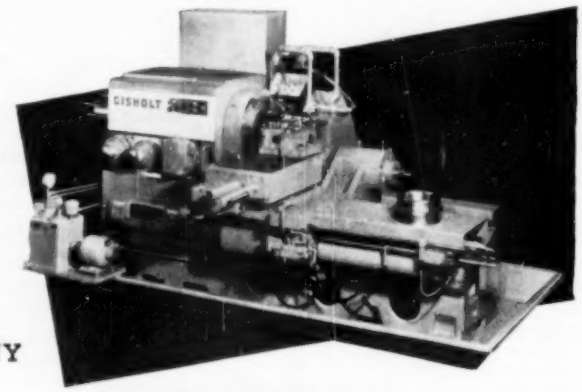
Speed is important, of course. But precision is the governing factor. How the Gisholt No. 24 does the job is a story that might mean real savings for you, too.

The No. 24 Hydraulic Automatic Lathe is a larger version of the famous No. 12 that has an outstanding success record on hundreds of jobs. If you have large volume precision work up to 24" diameter, the Gisholt No. 24 is the machine to investigate. Write for full information.

GISHOLT MACHINE COMPANY
Madison 10, Wisconsin



First Operation: Chucked on OD with 3-jaw hydraulic chuck, part is turned up to the jaws, faced, chamfered, bored and bore radius formed. Cam relief on rear tool block turns boring bit clear of workpiece as it is withdrawn.



Second Operation: Part held on expanding arbor by hydraulic pressure is finish turned, faced, chamfered and bore radius formed. Special rocker arm type carriage at rear tips in shaving tools to form both roller grooves with feed of .003" to .0045."

THE GISHOLT ROUND TABLE *represents the collective experience of specialists in machining, surface-finishing and balancing of round and partly round parts. Your problems are welcomed here.*

GISHOLT

TURRET LATHES • AUTOMATIC LATHES
SUPERFINISHERS • BALANCERS • SPECIAL MACHINES

CENTRIFUGAL PUMPS

that prove their worth continuously

No. 240

No. 206

No. 220

PERFORMANCE RECORDS of Brown & Sharpe Motor-Driven Centrifugal Pumps come from within our plant as well as from customers. Hundreds of our own machines are equipped with these pumps. Their dependability, durability and adaptability are scrutinized continuously. Actual operating experience confirms the choice of materials, the designs and the construction of these pumps.

Whenever you have a job for a centrifugal pump . . . handling liquids of relatively low viscosities at low heads, for large volumes, or for liquids containing particles of grit and abrasive . . . consider the advantages of pumps that have proved their worth under the most exacting conditions . . . Brown & Sharpe Pumps. Send for latest pump catalog. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

Choice of Styles and Capacities

Brown & Sharpe Centrifugal Pumps are available for vertical and horizontal mounting, for submerged or non-submerged installation, with ¼ and ½ H.P. motors.

Nos. 205, 206, 206A, 207 and 212 are designed for submerged mounting in a tank.

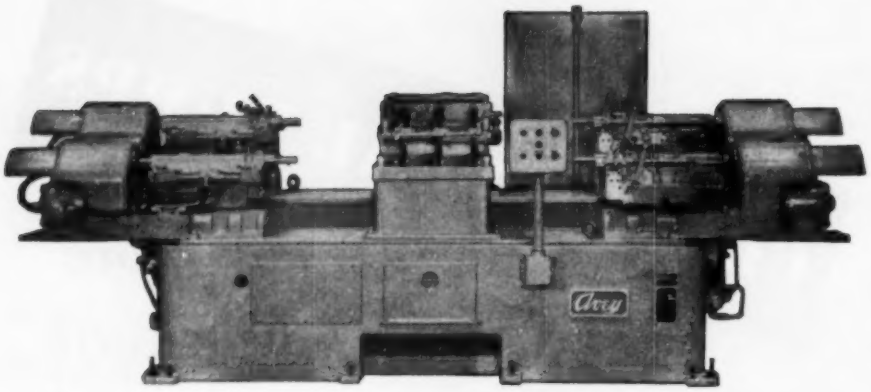
Non-submerged styles include Nos. 220 and 225, and 240 and 245 (for vertical or horizontal installation on tank side).

IMPORTANT FEATURES

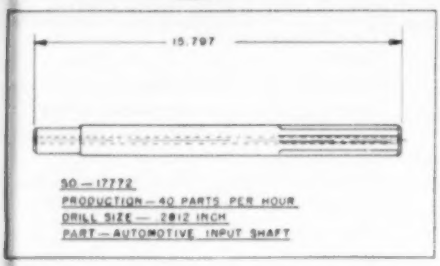
- Simple Construction . . . strong and durable. Balanced hydraulically. Designs provide stability without bearing at the impeller end of shaft.
- Splash-proof motors . . . totally enclosed for protection from vapors, dust and moisture.
- Permanently-sealed ball bearings . . . no lubrication, adjustment, inspection, cleaning or other maintenance needed. Precision seals retain grease . . . lock out dirt and moisture.
- Amply powered . . . sufficient H.P. to handle liquids within specified ranges.

We urge buying through the Distributor

BROWN & SHARPE PUMPS B·S



Avey HORIZONTAL DEEP HOLE DRILLING MACHINES

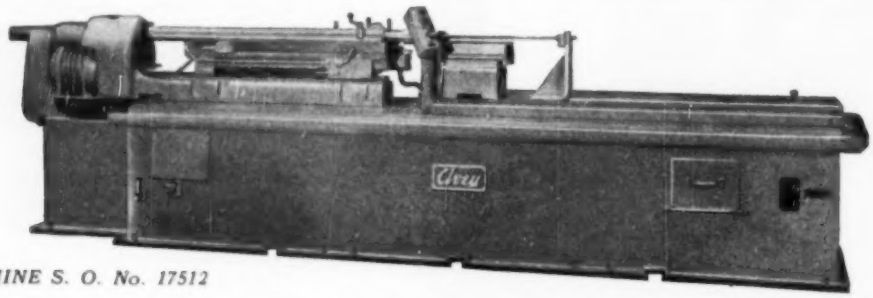


Fixtures—The fixtures were Vee Block type hand clamping to accommodate one part each.
Material—8641 Steel.

MACHINE S. O. No. 17772

Consists of four No. 1 *Avey-draulic* (hydraulic) Deep Hole Drilling Units mounted horizontally on a well-ribbed fabricated steel base. The Units having 12″ ram travel were arranged in pairs to drill a $\frac{7}{32}$″ diameter hole 14½″ deep from both ends. An electrical interlock was provided to prevent drill interference. The coolant system and hydraulic power source were incorporated in the base. Machine as illustrated conformed to Automotive Standards.

Write for Engineering Details



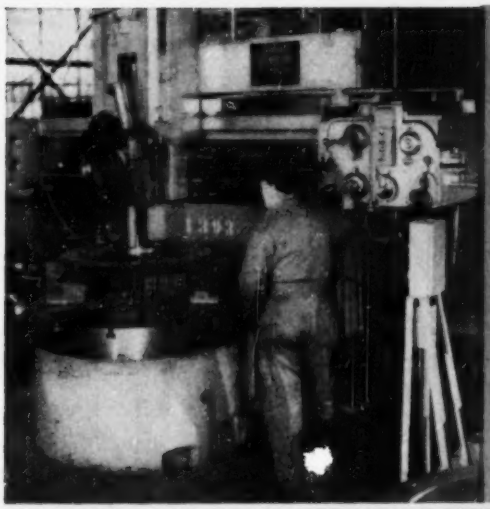
MACHINE S. O. No. 17512

The operation on this machine is to drill a 30″ hole in steel from one end only—using a conventional Deep Hole Twist Drill $\frac{7}{16}$″ in diameter. The ram travel of the *Avey-draulic* Unit was extended to 32″. During runoff tests, holes were held to as little as .003 to .005 total runout—tolerance, of course, depending on drill grind, heterogenity of metal, and other varying factors.

Drilling time was reduced to one-third of previous method. Drill breakage was reduced to a minimum by New Exclusive Torque-matic Control.

Avey DRILLING MACHINES
CINCINNATI · OHIO

THE AVEY DRILLING MACHINE CO.
CINCINNATI 1, OHIO



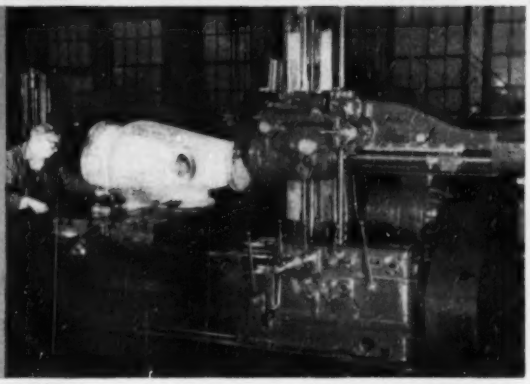
MAN-AU-TROL
VERTICAL
TURRET LATHES

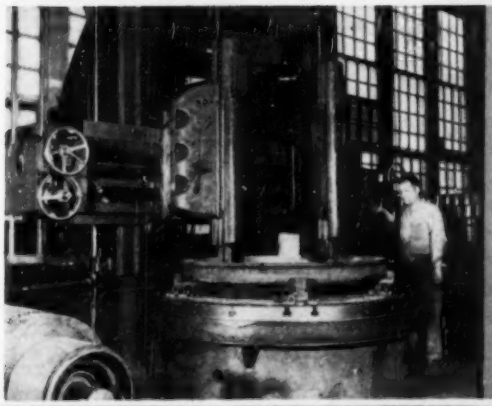
MANUAL OR AUTOMATIC

Operation For Short Run Jobs or the Longer Production Runs.

BULLARD
Universal
FOR
HORIZONTAL BORING MILL JOBS

Performance Plus Utility





CUT MASTER
VERTICAL
TURRET LATHES
IN 6 SIZES
30 INCH TO 74 INCH

Assured Accuracy and a Plus in manufacturing Economy. Simultaneous cutting with three heads.

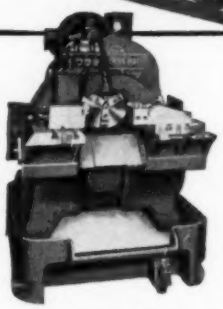
THE BULLARD COMPANY
BRIDGEPORT 2, CONNECTICUT

PROOF—you can get finished parts FASTER with the new Acme-Gridley 12" Chuck-matic

This new single spindle chucker is built for heavy-duty cutting and a minimum of idle time for loading and unloading.

The typical machine times shown above aren't theoretical. They're only a few examples of the kind of work (both short and long run) you can turn out in less time—accurately—at lower cost.

If you're doing heavy-duty chucking work, you'll be interested in a new book we've prepared. It shows 16 jobs similar to the one above—all done on the Chuck-matic. Ask for bulletin SC 46-A.



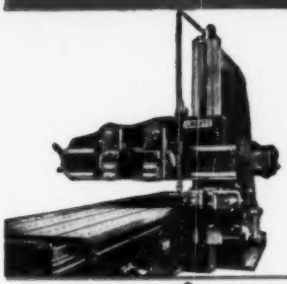
The rugged, powerful Chuck-matic is built for speeds and feeds as fast as carbide-tipped tools can take it. Compact, yet simple in design, its operation is semiautomatic. An unskilled operator can run as many as four machines.

The NATIONAL ACME CO.

170 EAST 131st STREET · CLEVELAND 8, OHIO

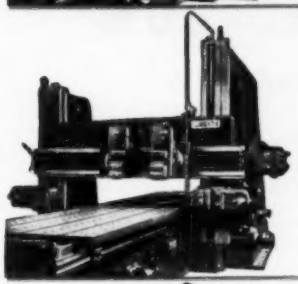
Acme-Gridley Bar and Chucking Automatics: 1-4-6 and 8 Spindle • Hydraulic Thread Rolling Machines • Automatic Threading Dies and Taps • The Chronolog-Limit, Motor Starter and Control Station Switches • Solenoids Centrifuges • Contract Manufacturing

LIBERTY BUILDS 3 great PLANERS



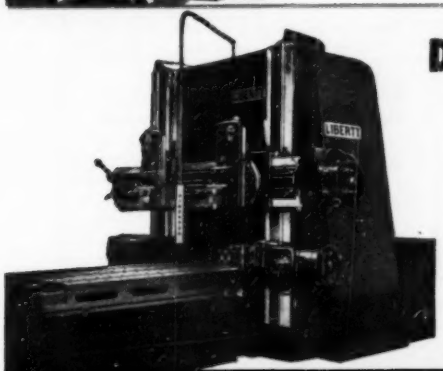
OPEN SIDE

For shops handling work of variable widths. Wide-faced housing and motorized clamp give rigidity for heavy roughing cuts and finishing. Dual control; electric feeds; rapid traverse to all Heads in all directions.



CONVERTIBLE

For exceptional rigidity on variable widths. Two, three or four heads. Offset heads permit closest approach of tools. Double balanced driving gear and pinions. Extreme accuracy.



DOUBLE HOUSING

For rapid production combined with accuracy. Two, three or four heads. Extremely rigid; handles production work with maximum cutting feeds and speeds. Table pulled into tool. Electric clamping and dual control for ease of operation; high production.

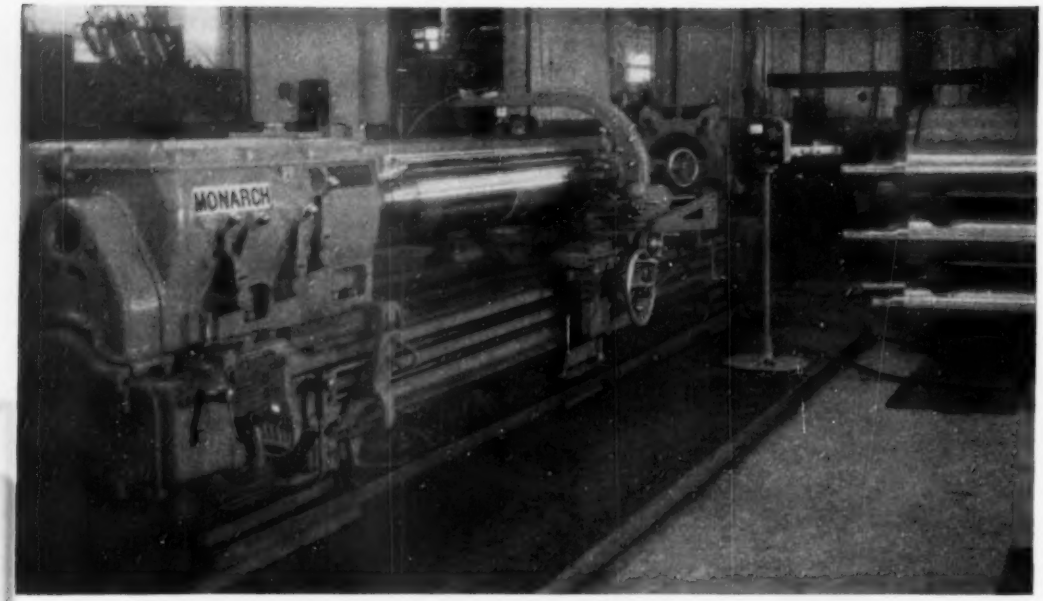
Write for catalog giving complete details.

All lengths, 24" x 24" wide and larger.

LIBERTY PLANERS, INC.
HAMILTON, OHIO

GENERAL DISTRIBUTORS: BRYANT MACHINERY & ENGINEERING COMPANY, 400 W. MADISON ST., CHICAGO 6

Exclusive Representatives in All Principal Cities



TURNING TIME REDUCED 80%

Printing Press Rolls Machined in 1½ Hrs. Instead of 7½

One fifth of former time! That's the kind of "*peak production at a profit*" you can expect with Monarch's Air-Gage Tracer-controlled lathes.

But peak production is only part of the story. Accuracy is spelled out with a capital "A". On this job, for example, necks and body of the roll are turned complete, and shoulder spacing on the ends of the roll —88½" apart—is held to + .001" – .000"!

The combination of air-gage accuracy with Packaged Controls and carbide tools permits exact duplication of parts in floor-to-floor times that are second to none.

You can't beat the Air-Gage Tracer's low production costs, either. Single-point turning means lower tool costs, faster set-up times, less machine overhead. And lot size is no limitation: you can trace from a round or a flat template—whether you're turning out two or two thousand parts.

This duplication principle is ideally applicable for stepshafts, contours and taper turning or boring. It brings the speed of automatic lathe operation within reach of every production job. May we show you how it can cut costs in your shop?

JOB FACTS

Part: Printing Press Roll

Material: SAE 1045 Forging

Size: 107" x 14" Diam.

Machine: Monarch 25 x 144 Model N Engine Lathe equipped with Air-Gage Tracer and Packaged Controls

Tooling: Carbide Tipped

Operations: Turn Necks and Body complete

Tolerance: + .001" – .000" between Shoulders

Former Time: 7½ Hours

Monarch Time: 1½ Hours

ACCURACY · ECONOMY · LONG LIFE

Monarch TURNING MACHINES

THE MONARCH MACHINE TOOL CO. • SIDNEY, OHIO

FOR A GOOD TURN *FASTER* — TURN TO MONARCH

"Change the Steel"... we suggested

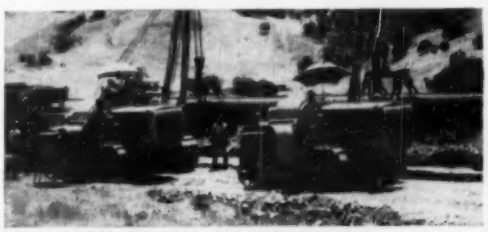
A 14.3% increase in production and a 300% increase in tool life are potent factors in reducing costs. Especially when they're obtained on a vital part like this that requires considerable machining to very close tolerances.

Trackson Company, Milwaukee, in producing this drum shaft for the winch of their famous "PIPE LAYER," formerly used 4¼" round bars heat treated to 269-321 Brinnel. Low tool life and machining difficulties ran up the cost and slowed production.

After studying the problem, one of our metallurgists suggested a special U·S·S Carilloy Steel. It worked like a charm . . . gave not only better machinability but better mechanical properties as well. "As a result," says Trackson's purchasing agent, "we feel that many other of our applications requiring considerable machining should be made of this steel."

This steel is only one of the many superior alloy steels we produce for the automotive and other industries. But it happens to be just the *right* analysis for a job like this. We were able to recommend it with confidence because of our unusual background of research and experience.

If you want similar constructive cooperation, bring your steel problems to us. Because we produce alloy steels in all grades—in all finishes and treatments—and in the widest range of forms and sizes, our recommendations to you are based solely on the particular requirements involved. In other words, *we fit the steel to the job, not the job to the steel.* This practical approach to steel application has saved many individual steel users thousands of dollars yearly in lower production costs. We'd be glad to help you make similar savings.



Trackson MD8 Pipe Layers laying 34-in. pipe line through rugged terrain from Needles to Milpitas, Calif. Heavy duty operation like this demands plenty of reserve strength in all vital parts—Carilloy Steel in the winch main shaft supplies it.

CARNEGIE-ILLINOIS STEEL CORPORATION, PITTSBURGH
COLUMBIA STEEL COMPANY, SAN FRANCISCO · TENNESSEE COAL, IRON & RAILROAD COMPANY, BIRMINGHAM
UNITED STATES STEEL SUPPLY COMPANY, WAREHOUSE DISTRIBUTORS, COAST-TO-COAST · UNITED STATES STEEL EXPORT COMPANY, NEW YORK

USS

Carilloy Steels

ELECTRIC FURNACE OR OPEN HEARTH — COMPLETE PRODUCTION FACILITIES IN CHICAGO AND PITTSBURGH

0-731

UNITED STATES STEEL

"Get a

SIMONDS SAW

Job-designed

for fast, low-cost Cold Cutting"

Inserted Tooth Saws

Full high-speed steel teeth for long wear, securely held in a tough alloy steel plate, make this the top production saw for heavy duty cutting. The teeth hold their cutting edges at high temperatures, permitting feeds of nearly double those of solid saws on ferrous and non-ferrous metals. All teeth are perfectly ground to side, top and down clearances, and are easily replaced.

Segmental Saws

Combining solid-tooth thinness with inserted-tooth economy, this saw leaves a remarkably smooth finish. In finer teeth, possible with this design, it is especially effective cutting thin-walled sections. Alternate square and beveled fitting splits the chips three ways for easier cutting. Available with carbide-tipped teeth.

Solid Tooth Saws

Made of semi-high-speed and high-speed steels (in diameters 16" and under), these saws are heat-treated for maximum edge-holding properties combined with toughness. They are radially ground on special machines for perfect side clearance.

Simonds also makes saws of high-speed, semi-high-speed and T-11 (patented) steels to operate at higher speeds for cutting non-ferrous metals.

SIMONDS
SAW AND STEEL CO.

FITCHBURG, MASS.

Branch Offices in Boston, Chicago, Los Angeles, San Francisco and Portland, Ore. Canadian Factory in Montreal, Que.

SAY, RED,
THIS IS A GOOD PLACE TO WORK. I HAVEN'T HAD A SHUT DOWN BECAUSE OF TOOL FAILURE FOR WEEKS.
RED SHIELD:
SURE - THIS SHOP STANDARDIZES ON SHIELD BRAND CUTTING TOOLS. THAT'S WHY WE HAVE SO LITTLE PRODUCTION INTERRUPTION. THAT HELPS OUR PRODUCTION BONUS, TOO. IT SURE IS A GOOD PLACE TO WORK.

Tool Quality that gives uninterrupted production

IF interrupted production because of tool failure is taking a nick at your profits—try Standard Shield Brand Tools.

They are Foremost Quality in design—workmanship—material. Qualities that in themselves give you assurance of continuous performance.

Then, too, our service staff is trained and experienced—more than 69 years of accumulated knowledge of cutting tools is available to you through these Standard Men.

Standardize—and save. Call your Industrial Supply Distributor for prompt delivery of Standard Shield Brand Tools.

STANDARD TOOL CO. CLEVELAND 4, OHIO

New York · Detroit · Chicago · San Francisco

THE STANDARD LINE: *Drills · Reamers · Taps · Dies · Milling Cutters · End Mills · Hobs · Counterbores · Special Tools*

ARMSTRONG

ARMSTRONG TOOL HOLDERS

answer both . . .

1. **The problem of lowering costs**
2. **The problem of increasing output**

By providing permanent, multi-purpose, inexpensive ARMSTRONG TOOL HOLDERS that use cutters or bits that are quickly ground from standard high speed shapes (Saving: All Forging, 70% Grinding and 90% High Speed Steel), the Armstrong System of Tool Holders will reduce your tool cost to an absolute minimum.

By providing stronger, more efficient tools, carefully developed for each operation, as well as ARMSTRONG High Speed Steel, ARMALOY Cast Alloy Cutter Bits or Armide Carbide-Tipped Cutters as required for each job, ARMSTRONG TOOL HOLDERS permit greatly increased speeds and feeds, enable you to increase the hourly output of every lathe, planer, slotter, shaper, turret lathe and screw machine.

There is no surer way to lower costs and increase output, than to use the correct ARMSTRONG TOOL HOLDER for each operation on all machines.

Stocked by Leading Tool Departments

ARMSTRONG BROS. TOOL CO.

"THE TOOL HOLDER PEOPLE"

5215 W. Armstrong Ave. Chicago 30, U.S.A.

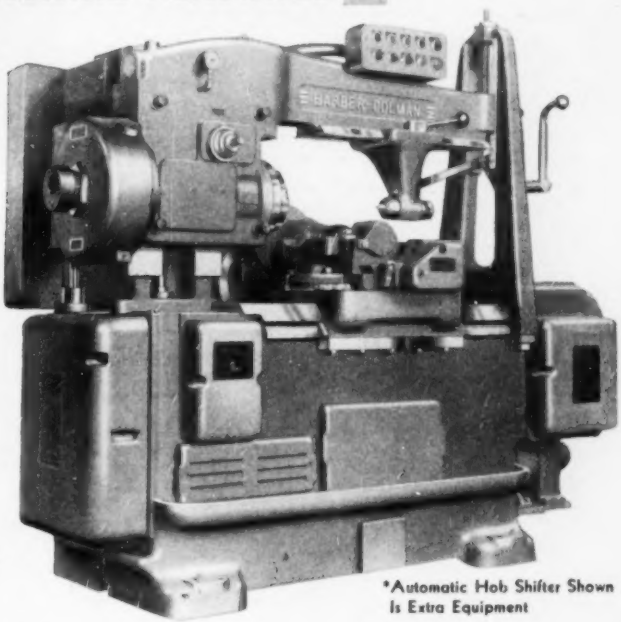
New York and San Francisco

Write for New S-48 Catalog just released.

IMPROVE HOBBING PERFORMANCE

WITH THESE

New MACHINE FEATURES



*Automatic Hob Shifter Shown Is Extra Equipment

NEW AUTOMATIC HOB SHIFTER*

BARBER-COLMAN No. 16-16 HOBBING MACHINES

INCREASES TOOL LIFE UP TO 50%

New STANDARD FEATURES

40° R. H. HELIX HOB SWIVEL
6 Inch Minimum Clearance

NEW FEED, TRAVERSE SELECTOR
Electrically Actuated Jaw-Clutch

NEW HOB SLIDE
Full Length Gib and Rear Bearing

ONE FLAT, ONE VEE BEDWAY
Greater Accuracy and Rigidity

Splined Change Gears, with all Index, Feed and Differential Gears Interchangeable — New Milling Machine Taper in Hob Spindle — Bronze Index Gear For Higher Speeds — these improvements are the result of conversations with leading gear manufacturers, to provide greater accuracy, tool life control and dependable operation. The New Automatic Hob Shifter, optional on new machines, will also be available for installation on field machines. Call your Barber-Colman representative today for additional information regarding application to your present equipment.

Write for this New Bulletin, describing these new features and improvements. Ask for Bulletin No. 6124.

BARBER COLMAN

Barber-Colman Company

GENERAL OFFICES AND PLANT, 6134 LOOMIS ST., ROCKFORD, ILLINOIS, U. S. A.

Laboratory Products for MEASURING THICKNESS

G-E X-Ray and Beta-Ray Thickness Gages
—for measuring moving strips

These gages enable you to save in two ways in the high-speed production of sheet or strip materials:

1. You can cut scrap losses

Because these equipments indicate thickness as soon as the strip starts through the mill, you can reach gage in a hurry.

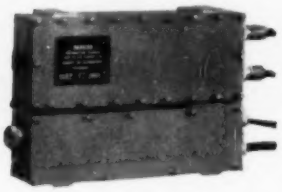
Operators at Weirton Steel Co., West Virginia, for example, report that their G-E X-Ray Gage enables them to reach gage on the first strip.

2. You can make savings in raw materials

Because the gages enable you to hold close tolerances, you can produce the maximum amount of strip or sheet from raw material.

X-Ray Gages are for heavy-duty work in steel mills. Gages are available for measuring thickness of hot strip from .040 to 190 mild steel; of cold strip, from .005 to .040 mild steel. Write for GEC-471.

The Beta-Ray Gage is a general-purpose device for measuring sheet or strip metals, paper, rubber, glass, textiles, and plastics weighing from 5 to 300 ounces per square yard. Write for GEC-485.



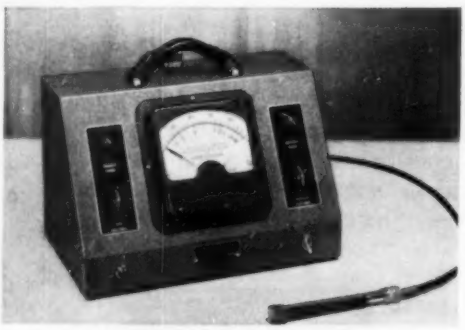
Beta-Ray Gage measures moving sheet or strips which are wet, sticky, highly polished, or soft.

G-E Thickness Gages, Types A and B
—for measuring nonmagnetic materials

These gages help you to reduce scrap and rework expense by enabling you to spot quickly plating or coatings which are so thin that they do not meet specifications, or so thick that they waste materials.

The gages measure glass, plastics, paper, cellophane, mica, copper, brass, lead, and other nonmagnetic materials which can be placed over a magnetic reference plate.

Type A is for measuring the thickness of light plating; Type B, for heavy plating, or for bearing linings and paint. Write for GEC-319. Apparatus Dept., General Electric Company, Schenectady, New York.



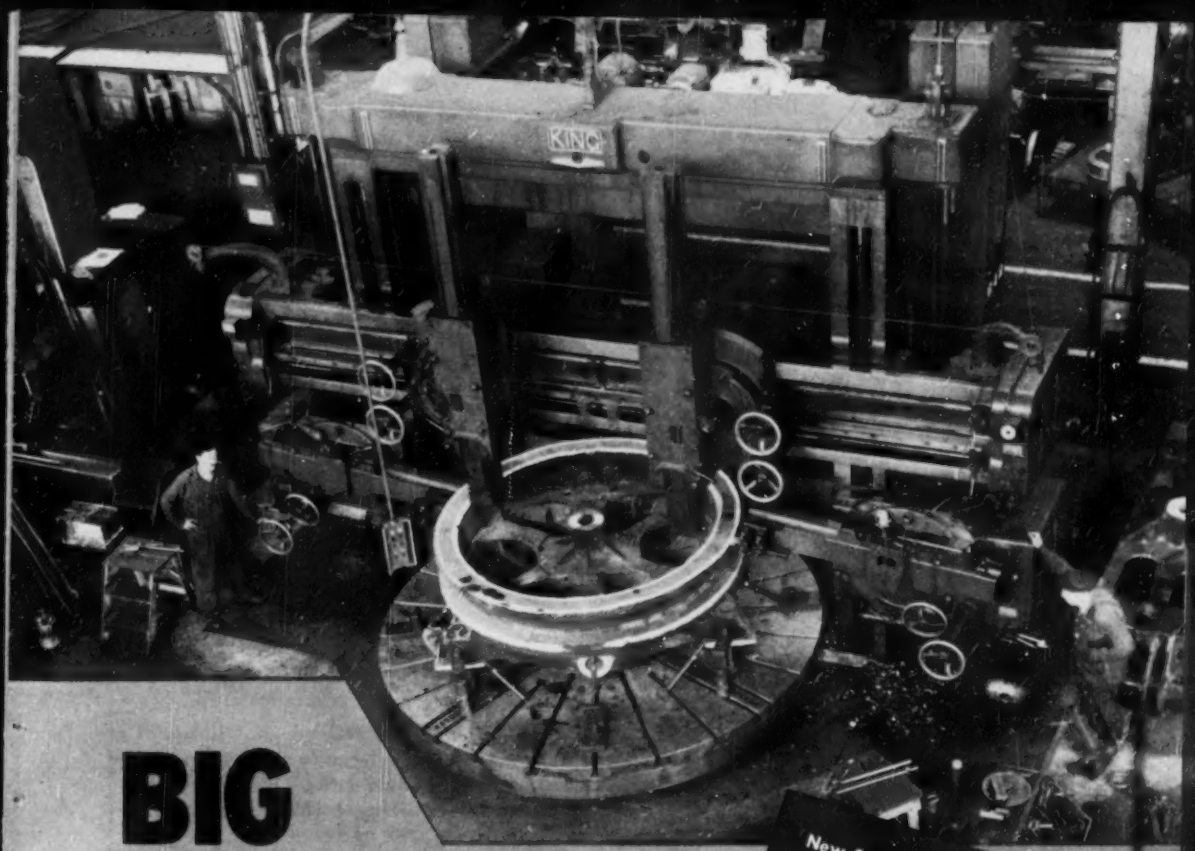
Type A Gage is ideal for production-line use on jobs such as measuring thickness of copper plating on parts for electronic tubes.

Type B Thickness Gage is a low-price, general purpose gage for measuring thickness of paints, heavy platings, bearing linings. Range: 0.0001 to 0.1 inch.

FOR HELP ON your measuring and testing problems . . . call the nearest G-E sales office

You Can Put Your Confidence in—

GENERAL ELECTRIC



BIG

Production Performance ... Profit Potential

WITH 4-HEAD NEW SERIES KING

New Series 144" KING turning the truck frame of a Bucyrus-Erie power shovel. All four heads are operating at once. The two swiveling side heads permit machining the tapered roller track with single point tools, at much higher speed than would be possible with a large form tool.

Here's another striking example of costs brought down . . . *down* . . . DOWN, with New Series KING Vertical Boring & Turning Machines. KING Mills save time, save money, improve quality, on the *complete* range of vertical boring and turning work—light or heavy, large or small. It will pay you to investigate KING cost-cutting advantages. Ten sizes—30" to 144"—the widest size range among general-purpose vertical boring mills.

WRITE FOR NEW CATALOGS!

New Illustrated KING Catalogs give full description of machines and detailed specifications. Catalog K-1 features Machines sizes 30", 36", and 42"; K-2, sizes 52", 62", and 72"; K-3, sizes 84" and 108"; K-4, sizes 120" and 144".

American Steel Foundries

KING MACHINE TOOL DIVISION

CINCINNATI 29, OHIO

Builders of King Vertical Boring & Turning Machines and Sebastian Lathes

Put it on the BLANCHARD

. . . for stock removal

These side plates, approximately 9″ x 18″, are ground from the rough on a No. 18 Blanchard with 36″ chuck — requiring 1/16″ to 1/8″ stock removal per side.

. . . for close tolerance

These plates are held flat within .003″, parallel to .001″, and to a dimension tolerance of ±.001″. A Blanchard 20C50 Cylindrical Wheel is used.

. . . for speed

Three chuck loads of 5 pieces each, give a production of 30 surfaces per hour. Feed is .020″ per min.

. . . for comparison

A comparison of the Blanchard Method with your present methods may be a pleasant surprise. May we grind some samples for you?

V-348

NO. 18 BLANCHARD SURFACE GRINDER

Send for your free copies of "Work Done on the Blanchard," third edition, and "Art of Blanchard Surface Grinding."

PUT IT ON THE BLANCHARD **THE BLANCHARD MACHINE COMPANY**
64 STATE ST., CAMBRIDGE 39, MASS., U.S.A.

A GROUNDED 200 hp motor recently put a large press out of commission for a midwest steel-tank firm. Dietz Electric, A-C Certified Service Shop, picked up the motor Saturday a.m. The stator was rewound and the motor back on the press in 36 hours — with no lost production time!

GET, FAST, RELIABLE SERVICE like this wherever your plant is located from your nearest A-C Certified Service Shop. There are 80 of these shops in every major industrial area in the U. S.

These independent shops are hand-picked for fine workmanship, high business standards, and excellent facilities. Their work meets factory-established standards.

When you need new motors — or matching control — call your nearest A-C Certified Service Shop or Authorized Dealer. A-3067

ALLIS-CHALMERS, 999A SO. 70 ST.
MILWAUKEE, WIS.

ALABAMA
Birmingham—Elect. Repair & Serv. Co.
Montgomery—Standard Electric Co.

ARIZONA
Globe—Copper Electric Co., Inc.

CALIFORNIA
San Diego—Calif. Elect. Works
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Oakland—T. L. Rosenberg Company
San Francisco—Weidenthal-Goslmer
San Jose—Rosendin Elec. Works

COLORADO
Denver—Baker Electric Company

CONNECTICUT
Hartford—Charles H. Leppert
Waterbury—Elec. Motor Repair Co.

FLORIDA
Jacksonville—Turner Elec. Works
Miami—Penninsular Armature Wks.
Tampa—Tampa Armature Works

GEORGIA
Atlanta—Bearden-Thompson Elec. Co.
Columbus—Smith-Gray Electric Co.

ILLINOIS
Chicago—Chicago Electric Company
Marion—Giles Armature & Elec. Wks.

INDIANA
Indianapolis—Scherer Electric Co.
Evansville—Evansville Elec. & Mfg. Co.

IOWA
Sioux City—Smith Elec. & Supply Co.

KANSAS
Wichita—Tarrant Elec. Machinery Co.

LOUISIANA
New Orleans—Industrial Electric
Shreveport—Shreveport Arm. & Elec.

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Brewer—Stanley J. Lem Company

MARYLAND
Baltimore—Keystone Elec. Co., Inc.

MASSACHUSETTS
Canton—A. S. Tracy
Roslindale—Ramney Electric Motors
Springfield—Elec. Motor Repair Co.

MICHIGAN
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MINNESOTA
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Minneapolis—Parsons Electric Co.

MISSISSIPPI
Vicksburg—Ludke Electric Company

MISSOURI
Kansas City—Boese-Hilburn Elec. Co.
St. Louis—French-Gerleman Elec. Co.

NEBRASKA
Omaha—Omaha Electrical Works

NEW JERSEY
Atlantic City—Charles A. Buckley
Paterson—Elec. Service Repair Co.
Trenton—Lockwood Elec. Motor Serv.

NEW MEXICO
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NEW YORK
Buffalo—Robertson Electric Co., Inc.
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New York—Consolidated Elec. Motor
Rochester—Vanderlinde Elec. Corp.
Utica—Mather Evans & Diehl Co.
Watertown—Watertown Electrics, Inc.

NORTH CAROLINA
Charlotte—Southern Elec. Serv. Co.
Rocky Mount—Hammond Electric Co.

OHIO
Cincinnati—Cincinnati Elec. Equip.
Cincinnati—Electric Service Co.

THERE ARE 80 A-C ALLIS-CHALMERS "Certified" Service Shops THROUGHOUT THE U.S.A.!

Cuyahoga Falls—A-C Supply Company
Youngstown—Winkle Electric Company

OKLAHOMA
Oklahoma City—Southwest Elec. Co.
Tulsa—Smith-Milligan Electric Co.

OREGON
Eugene—Kalen Elec. & Mach. Co.
Klamath Falls—Ray Bigger Elec.
Portland—Milwaukee Machinery Co.

PENNSYLVANIA
Johnstown—Universal Elec. Mfg. Co.
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Philadelphia—Elec. App. Repair Co.
Pittsburgh—Penn. Elec. Coil Corp.
York—Industrial Electric Company

RHODE ISLAND
Woonsocket—Dauray & Bardsley, Inc.

SOUTH DAKOTA
Sioux Falls—Elec. Motor Repair

TENNESSEE
LaFollette—Standard Armature Wkr
Memphis—Ind. Elec. & Supply Co.

TEXAS
Amarillo—G. E. Jones Electric Co.
Dallas—Industrial Elec. Equip. Co.
El Paso—B & M Machinery Company
Ft. Worth—Central Electric Company
Houston—Roy A. Berentz Company

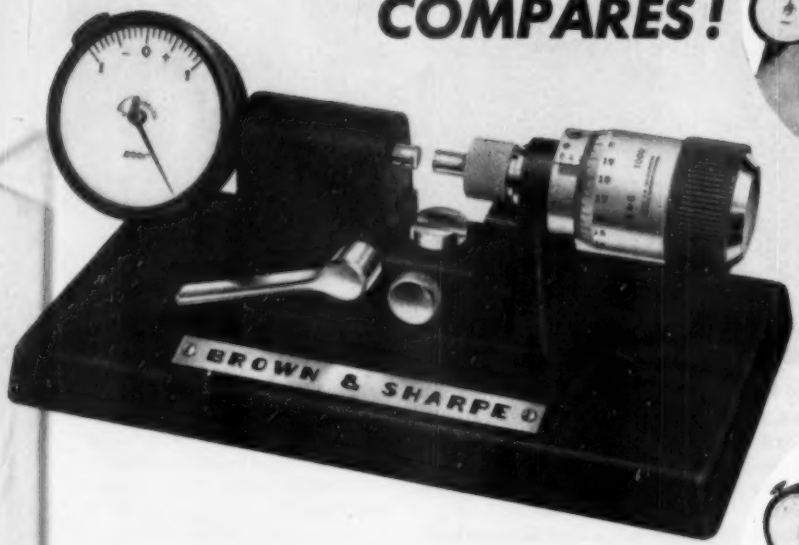
VIRGINIA
Richmond—Wingfield & Hundley
Roanoke—Virginia Armature Company

WASHINGTON
Spokane—Lee F. Austin Company

WEST VIRGINIA
Charleston—Charleston Elec. Supply

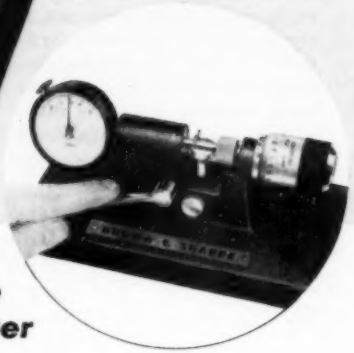
WISCONSIN
Green Bay—Beemster Electric Co.
Milwaukee—Dietz Electric Company
Wausau—Electric Motor Service
Wis. Rapids—Staub's Elec. Shop

NOW! A BENCH MICROMETER that both MEASURES and COMPARES!



MEASURES
Ideal for measuring wire, tube filaments, watch parts, and other small precision products.

COMPARES
A finger operated lever is the only motion required for multiple inspection of duplicate parts.



No. 245 *The New Brown & Sharpe Indicating Bench Micrometer*

Here's a sensational new development that has no counterpart in the field of measuring devices! It's the new Brown & Sharpe Indicating Bench Micrometer No. 245 with original features — exclusive advantages — that serves multiple functions:

MEASURES to an accuracy of .0001" over range of 0 to ½". Reads directly from the thimble. Or, for fast setting and measuring, can be set to nearest thousandth and then read in increments of .0001" on dial gage.

COMPARES . . . for multiple inspection of small parts. Dial indicator gives direct readings of variations from standard sample, in ten-thousandths. No need for additional standards.

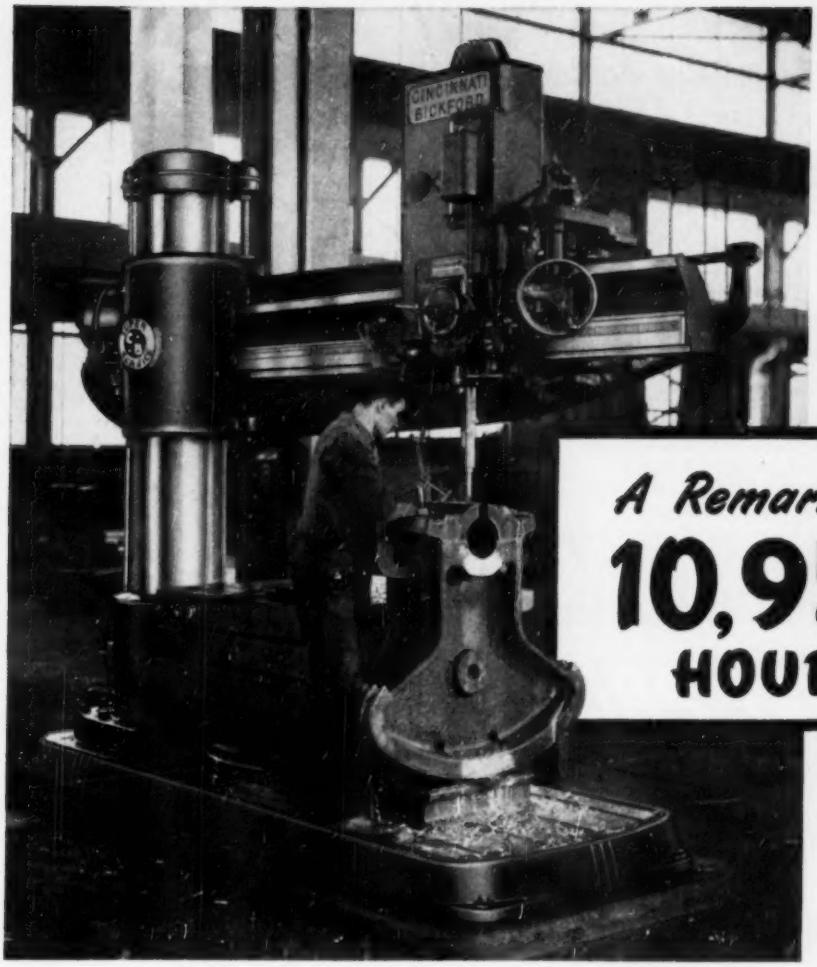
What's more, it's fast! A slight, short movement of the anvil retractor lever permits instant insertion or removal of work pieces.

Measuring surfaces of the No. 245 are tipped with tungsten-carbide for minimum wear. Anvil movement is in straight line — frictionless — with measuring surfaces parallel in all positions. Adjustable work support facilitates centering. Measuring pressure is constant and adjustable — factory-set at any pressure you specify, from 8 oz. to 2 lb.

See the new No. 245 Bench Micrometer at your distributor's, or write today for illustrated bulletin. Brown & Sharpe Mfg. Co., Providence 1, R. I., U.S.A.

We urge buying through the Distributor

BROWN & SHARPE



A Remarkable 10,950 HOURS

Perhaps the greatest test of both materials and workmanship in a machine is the test of uninterrupted production.

A Cincinnati Bickford Super Service Radial Drill was on a 24-hour schedule for 15 months at the Pittsburgh Steel Foundry, Glassport, Pa.

They tell us that the operators of this machine were not highly skilled but, due to the extreme simplicity of operation, did a fine job—and maintenance cost was zero over this period.

For durability, easy of operation and high production, use a Bickford Super Service Radial Drill.

THE CINCINNATI BICKFORD TOOL CO.
RADIAL AND UPRIGHT DRILLING MACHINES
SUPER SERVICE

Radials 7½" dia. col., 2½" arm, to 26" dia. col., 12' arm.
General purpose Uprights, 21" to 28" sizes.
Production Uprights, 21" to 28".
Jig Borers, Portable Horizontals,
Spacing Table Machines.

Equal Efficiency of Every Unit Makes the Balanced Machine

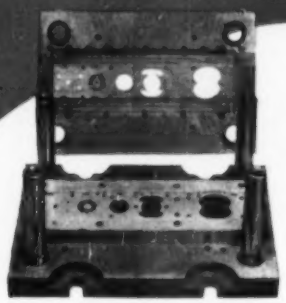
THE CINCINNATI BICKFORD TOOL CO. Cincinnati 9, Ohio U.S.A.

160 pieces a minute to tolerances of less than .0005"!

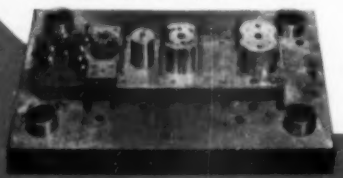
These rotor and stator elements are stamped in the six station die shown below in a 50-ton press at 80 strokes per minute. With half thousandth piece part tolerances, almost perfect die alignment is a must! That's why . . .

they built the die in a

DANLY PRECISION DIE SET



Die built by the Sherman Tool & Die Co., Charlestown, Massachusetts, for the Signal Manufacturing Co., Lynn, Massachusetts, in a Special Danly Precision Die Set



Danly precision makes every Danly Die Set a reliable base for the finest die work. They save time in the die shop because they are square and true . . . they assure longer production runs in the press because precision closure protects die components.

Standard Danly Die Sets are quickly available from a nationwide system of completely stocked assembly branches. Just phone for fast delivery, and for the finest in die set precision, always specify Danly.

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PRECISION DIE SETS . . . STANDARD AND SPECIAL

DANLY®

SPOT NEWS of Metalworking

- **You may bring your workers together** during working hours and urge them to vote against a union. Moreover, you don't have to let the union call a meeting on company time to answer you. National Labor Relations Board so told S. & S. Corrugated Paper Machinery Co., Brooklyn, in rejecting complaint of Machinists' Union.

- **Machine tools made in western Germany are being shipped to Russian satellite nations** with blessing of U.S. occupation officials, Jerome A. Raterman, president Monarch Machine Tool Co., states on return from three-months' European trip.

- **Automotive troubles: one prominent car maker has promoted** its automatic transmission so aggressively that it is having difficulty in selling 12,000 of its cars produced in period while automatic units comprised only small fraction of total output. Today its automatic transmission production controls its sales; and output has not been high.

- **York, Pa., and Kansas City, Mo., have been chosen for new plants by two** metalworking companies, partly because both have available a good supply of native workers. Also, York is accessible to east coast markets and to steel sources, and Kansas City is in strategic spot to reach national markets, with favorable freight rates, including water.

$800,000 in government bonds has been set aside as replacement reserve, in addition to normal depreciation reserve of 1.1 million on equipment originally costing $3.4 million, by a New England metalworking firm. Special survey showed this amount as added cost of replacement at higher postwar prices.

- **Industrial plant construction has lagged in postwar period,** averaging only 25% of total fixed capital outlays, as against 40% prior to 1930, according to analysis made by Machinery & Allied Products Institute. Some of reasons: (1) construction costs have risen much more sharply in relation to equipment prices than formerly; (2) shortage of outside equity capital; (3) decline in growth of nation's labor force. Almost 60% of existing structures are over 20 years old, nearly 30% are over 30 years old.

- **A 30° positive rake angle on super-HSS tools** has solved one company's problem in turning Nitralloy. The high-rake tools cut a chip 1¼-in. wide at 90 fpm with 0.004-in. feed and last 16 hr with no apparent dulling.

- **Seat threads can be put in valve body by modern equipment at eight times the rate** of 20-year-old machines, recent survey reveals.

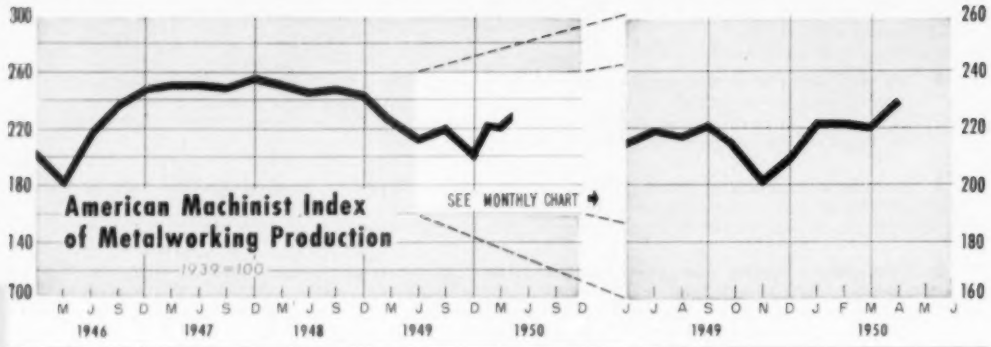
- **Uncertain conditions in Germany have spurred study by Mercedes-Benz** of moving its entire operations, employing 20,000 skilled workers, to Brazil. Company would like to assemble cars in Brazil, perhaps with motors made under license by National Motor Factory.

Better market for power tools should result from year-long series of tests just started by Army Engineers at Fort Belvoir, Va. Tests will compare everything from productivity to availability, 11 points in all. Tools that come out on top will be made a standard part of Army procurement.

- **First "Gyro-Bus" was displayed at Swiss Industries Fair at Basle.** It looks like a bus, has electrical flywheel drive, carries 26 seated and 26 standing passengers. Before each trip, flywheel is accelerated to 3000 rpm by connecting the 3-phase motor to usual 50-cycle, 3-phase current. This energy is enough to carry vehicle four miles before 1-min. stop is necessary for recharging.

- **Silver bearings is Navy's newest idea to get longer wear** out of its heavy-duty, light-weight engines. Navy won't say if pure or alloyed silver is used, but claims new bearings are "hardy, tough, and durable."

Gaging Metalworking



Production to Stay High All Summer

Metalworking operations will go through the third quarter with little if any letdowm from current spectacular rate. Fears that business might dip badly during summer months have about disappeared.

Even fourth quarter looks better with each week that passes. Metalworking management is feeling fine about short-term outlook. Mental reservations about 1950 have been almost wiped out.

• • •

Metalworking lines continue to break records. Automobile industry produced 177,398 units in first week after Chrysler resumed work. That is all-time high, a 9-million-a-year rate (which obviously will not hold for long).

• • •

U. S. gross national product—value of all goods and services produced—is estimated currently at $268 billion a year. It was $270 billion at peak reached late in 1948. Metalworking is feeling stimulus of this terrific purchasing power.

• • •

Upward revision of investments in new plant and equipment for 1950 will aid metalworking. Recheck of McGraw-Hill's annual survey shows industry now plans to spend 7% more this year than it anticipated.

Investment in new plant and equipment will be 3% higher in July-December period than in same period a year ago. Expenditures by manufacturing industries alone will be 10% up in second half as against first half of 1950.

• • •

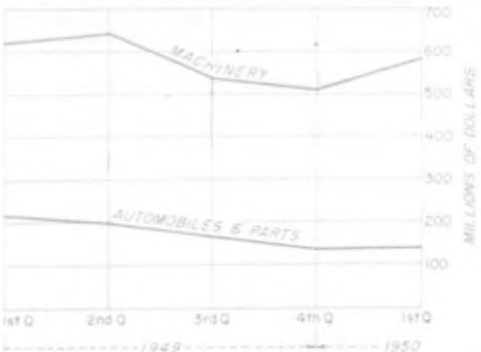
Automobile companies expect to spend 64% more ($460 million) in second half than in first six months. Manufacturers of industrial machinery will make outlay of $245 million, an increase of 7% over first half.

May and June figures on new orders and shipments of durable goods and machinery, when they finally are in, are almost sure to top old records in dollar volume.

Construction machinery builders are feeling construction boom in their business. Many of them can sell all earth-moving equipment they can produce this year. One maker is building new facilities to turn out scrapers and bulldozers because new plant capacity created since war is inadequate.

Tractor sales are at peak. Several manufacturers affirm fact that they will run at full tilt all year to try to keep up with demand.

1st Quarter Rise in Machinery, Auto Exports



		Total of Machinery and Autos & parts	Machinery	Autos & parts
1949—1st	quarter	842	622	220
2nd	quarter	843	643	200
3rd	quarter	709	539	170
4th	quarter	652	512	139
1950—1st	quarter	723	582	141

INDEX

	MAY '50	APR '50(p)	MAR '50(r)	APR '49
	235*	**229**	**220**	**222**
Machinery		220	213	220
Electrical Manufacturing		276	258	241
Automobiles, Trucks		200	195	193
Transportation Equipment		213	210	243
Other Metalworking		244	242	230

AMERICAN MACHINIST'S INDEX OF METALWORKING PRODUCTION is based on manhours worked in the five components above.

*Estimated (p) Preliminary (r) Revised

Sales of farm implements have been better than anticipated this spring. At least one maker reports that second quarter will be one of biggest in history. And third quarter looks good, too.

• • •

Plumbing and heating fixture people are getting a "shot in the arm" from housing boom. Their business, which had been declining since 1948, has taken an upward turn, with each succeeding month topping the preceding one.

• • •

Steel mills are falling far behind in filling requirements for carbon sheet and strip, silicon sheet, galvanized sheet and terne plate. Growing demand for stainless has resulted in extension of delivery promises.

Flat-rolled steel users in Chicago area are on rigid allocation from district mills and must go outside to get badly-needed tonnage at premium. Conversion steel is flourishing more than it was a few weeks ago. Some relief is looked for as third quarter wears on.

Majority of other steel items are not critical, if plenty of time is given mills to fill orders. Certain users have investigated possibilities of importing steel to ease things, but no price advantage is secured unless quality is sacrificed.

• • •

Non-ferrous metal market is very strong. Demand for copper has been far greater than expected. It promises to continue during June. Lead and zinc also are being consumed at high rate. Prices have been moving upward, with users keeping their eye intently on what prices may do further in near future.

• • •

Inventories of raw materials and component parts in hands of manufacturers are rising. But caution is the watchword. Companies don't want to get themselves into position they were in early in 1949, with excessive stock in warehouses and in factories.

• • •

Television production shows no signs of dropping off. Estimated 1950 output: 5½-6 million sets. Trend is toward concentration on 16-in. screen units. Example: one maker has abandoned 12-in. sets, is producing only limited volume of 14-in. units, is putting its energies mostly into 16-in. sets.

• • •

Forecast: television market next few years should absorb production of 4-6 million sets a year.

• • •

Motor truck industry is suffering by comparison with 1949. It should build about 1 million units this year, against 1.4 million units last year. Dealers are being compelled by some companies to take trucks in order to get passenger cars from factories.

WEEKLY BUSINESS INDICATORS

	Latest Week	Preceding Week	Year Ago
Business Week index of activity (1923-1925 = 100)*	206.7	205.2	186.7
Steel ingot operations (% of capacity)	101.3	100.1	95.6
Electric power output (million kilowatt-hours)	5,864	5,872	5,257
Production of automobiles and trucks	177,398	146,337	119.634
Engineering construction awards (Eng. News-Record; millions)	$206.0	$183.3	$157.8

MONTHLY BUSINESS INDICATORS

	Latest Month	Preceding Month	Year Ago
Index of industrial production* (1935-1939 = 100)	186	181	184
Index of durable manufacturers production* (1935-1939 = 100)	212	207	223
Durable goods manufacturers' sales* (millions)	$8,057	$7,461	$7,805
Electrical machinery manufacturers' sales* (millions)	$868	$789	$742
General machinery manufacturers' sales* (millions)	$1,249	$1,124	$1,325
Durable goods manufacturers' new orders (millions)	$9,113	$7,513	$7,185
Electrical machinery manufacturers' new orders (millions)	$988	$754	$754
General machinery manufacturers' new orders (millions)	$1,372	$1,196	$1,151

*Seasonally adjusted.

OVER $2,000 A MONTH SAVED*

On 5 hydraulic process millers using TEXACO REGAL OILS (R & O)

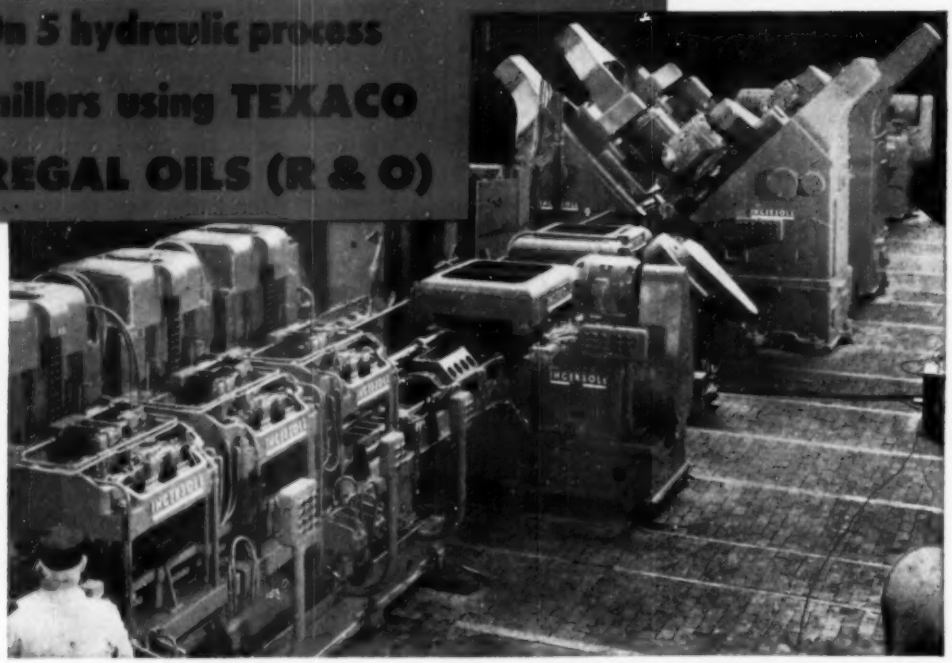


Photo courtesy of The Ingersoll Milling Machine Company

JUST by introducing *Texaco Regal Oils (R & O)* into the hydraulic systems of five Ingersoll Process Milling Machines, this plant is saving more than $2,000 a month. The Texaco Lubrication Engineer's report tells why—

"Although these machines are operating at top speed in extremely severe service, with *Texaco Regal Oils (R & O)* there has been an absolute minimum of downtime – no rust, no sludge, no foam, no sticking – none of the usual hydraulic oil troubles. In addition, service life of the *Texaco Regal Oils (R & O)* is several times that of any hydraulic oil previously used."

On the basis of this outstanding performance, use of *Texaco Regal Oils (R & O)* has been extended throughout the plant and to the hydraulic systems of new machines of all types as fast as they are installed.

A Texaco Lubrication Engineer will gladly tell you more about *Texaco Regal Oils (R & O)* and explain how you can use them to improve hydraulic efficiency and make worth-while savings. Just call the nearest of the more than 2,000 Texaco Wholesale Distributing Plants in the 48 States, or write The Texas Company, 135 East 42nd Street, New York 17, N. Y.

*Name of this Texaco user on request

TEXACO

TEXACO Regal Oils (R&O)

FOR ALL HYDRAULIC UNITS

TUNE IN . . . TEXACO STAR THEATER starring MILTON BERLE on television every Tuesday night. See newspaper for time and station.

American Machinist

MAGAZINE OF METALWORKING PRODUCTION ★ ESTABLISHED 1877

Preventive Maintenance Cuts Costs

Have you ever been in a long line of cars moving at a snail's pace along a main highway? Remember how often such a tie-up occurs because a lone motorist is stalled? His breakdown snarls traffic badly.

The same situation is created in a metalworking shop when a machine breaks down on a production line. The stalled machine tangles things up as badly as the stalled automobile does.

Especially in these days of sky-high labor rates, every alert management wishes to avoid machine breakdowns. They are expensive far beyond their own downtime.

There is an effective way to keep such breakdowns at a minimum, or perhaps eliminate them. Stop the trouble before it starts. Set up a preventive maintenance program in your shop.

MATTHEW A. CAVANAUGH, superintendent of plant maintenance at The Budd Company, Philadelphia, pointed out recently at a conference of the American Management Association, that preventive maintenance means three things:

1) Complete overhauling of machines.

2) Repairing of equipment when it first shows signs of giving trouble.

3) Analyzing and correcting of repeated troubles in a given machine, either within the plant or in conjunction with the manufacturer.

This matter of preventive maintenance is not something to delegate to a clerk. It requires careful planning and much education from the shop superintendent on down past the supervisors or foremen to the machine operators. It is a problem which demands the best thinking of top management.

If you operate a sizable shop, your task of establishing a maintenance staff is not too hard. You may be able to handle all phases of maintenance work without going outside.

ON THE OTHER HAND, if your shop is small, you may not have enough qualified people to do the maintenance job yourself. If that is the case, don't give up. Seek the services of outside companies to do at least certain parts of the work.

Your preventive maintenance program should be tied in closely with your production departments and their operations. Records should be kept on performance of all machines and periodical overhauls should be made.

The necessity for preventive maintenance is growing, as machines become more automatic and more complicated in design, and as each machine, on the average, is more important to over-all production than it used to be.

ONE OF THE FIRST questions asked, Mr. Cavanaugh states, is: "What caused this machine to go down and halt production?"

The best thing to do is to put into action a maintenance program which makes it necessary for management to ask this question only infrequently or not at all.

Burnham Finney

PHOTO—COURTESY MORRISON-DRABNER STEEL

the man who shears for a living uses Cincinnati Shears!

He gets a quick and satisfactory return on investment — many a Cincinnati Shear has totally paid for itself in less than a year.

Cincinnati Shears produce accurate blanks without costly dies or special setups — cut production costs to the bone. They satisfy a critical trade and promote business.

The machine tool like accuracy, the rapid gauging, the ability to shear quickly and satisfactorily make the Cincinnati All-Steel Shear a profitable machine in any shop.

Write for Catalog S-5, illustrating Cincinnati All-Steel Shears.

CINCINNATI

THE CINCINNATI SHAPER CO.

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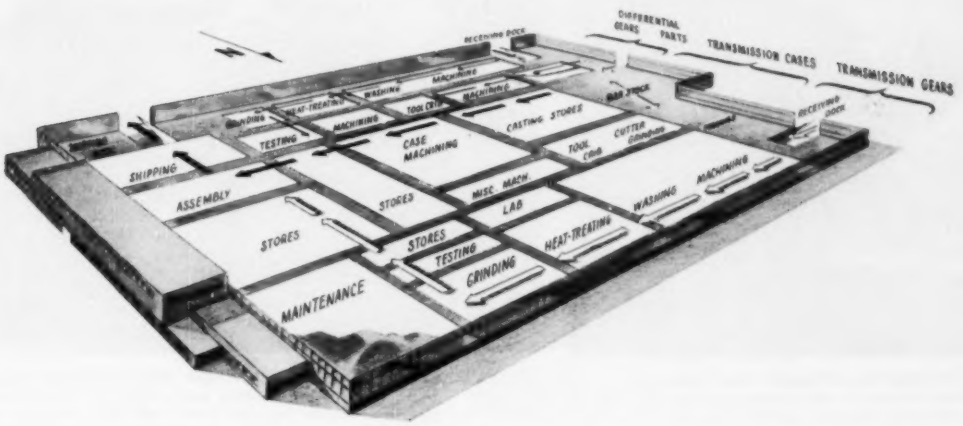
SHAPERS · SHEARS · BRAKES

PLANT LAYOUT: ***direct-line movement reduces handling costs***



Material movement through plant follows direct line from west end, where raw material is received at a designated entrance, through 3 major sections of plant to assembly in an east-central location and then on to shipping in southeast corner. New single-story building provides 435,000 sq ft of floor area and was specifically planned to reduce handling costs in an operation that involves hundreds of different items per month

RIGHT LAYOUT AND GOOD HANDLING CUT OVERHEAD 10%

BY MILES J. ROWAN, ASSOCIATE EDITOR

Essentially a production job shop, Clark's new Jackson Plant reduces manufacturing overhead because:

1 . . . Product-line layout cuts the number of handling operations

2 . . . Direct-line production shortens handling distances

3 . . . Fork trucks and other mechanization lower the cost of necessary handling

4 . . . Manufacturing cycles are shorter

5 . . . Inventory turnover is greater

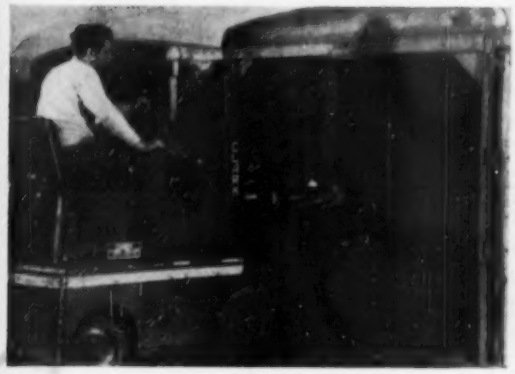
6 . . . Supervisory teamwork is better and quality is higher

CLARK EQUIPMENT COMPANY'S new transmission plant brings the advantages of product-line manufacture to an operation that is predominantly jobbing in character. Only recently brought up to full production, the new plant brings under one roof facilities formerly housed in three separate buildings and makes possible manufacturing economies that greatly strengthen Clark's competitive position in the transmission field.

In seeking lower production costs, Clark hit where its greatest possibilities for savings existed —in overhead, and primarily in handling. Surveys of existing facilities showed that major inefficiencies could be eliminated only through rearrangement of equipment for smooth, steady material movement through the plants. Re-layout for efficient handling was essential, yet more space was needed and there was no room for expansion in the existing buildings. The alternative was to build.

Building also was attractive for another reason: It offered an opportunity to wipe out a troublesome location problem. The gear and transmission plants were 120 miles apart. This caused difficulty in licking manufacturing problems that required

RECEIVING: *well-equipped dock speeds material into plant*



Self-adjusting hydraulic dock plates speed operation of fork trucks in unloading palletized castings, or forgings and other material received on skids. Incoming castings go directly onto trolley conveyor for automatic painting operations enroute to storage. Conveyor loops through dock near sidewall, leaving ample dock area for unloading three trucks simultaneously. Portable conveyor sections and an overhand crane also cut manual handling

mutual discussion and agreement. The two organizations were too far apart to understand one another's problems as they should. Putting both together in one plant would provide the ideal operating arrangement.

The new plant meets Clark's requirements on both of these points. Cranes, fork trucks, and conveyors operate smoothly in a layout that not only cuts handling to a minimum but at the same time reduces the manufacturing cycle, thereby shortening delivery schedules and providing greater inventory turnover. And the fact that gear and transmission personnel can analyze manufacturing troubles together has reduced defective work charges and has permitted even higher standards of quality in the product. The result is a 10% reduction in overhead, which, in effect, is equivalent to a 30% reduction in the cost of direct labor.

Fork Trucks Speed Handling

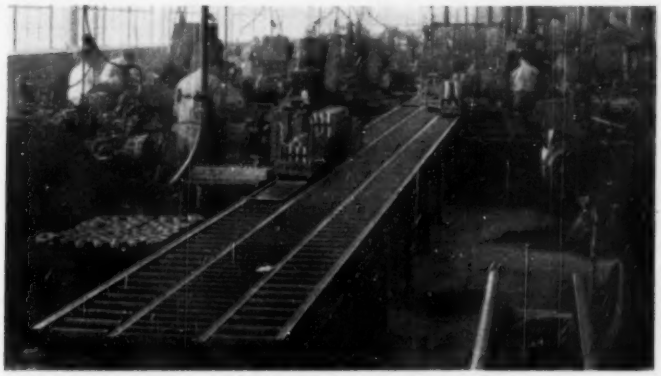
A combination of fork trucks and chain conveyor makes a very effective method of handling goods directly from highway trucks to storage areas.

Material received on pallets, in tote boxes, or on skids is unloaded directly from the truck to the stor-

STORAGE: *palletizing permits unit-load handling and high tiering*

Assembly of unit loads in storage area integrates conveyor and fork-truck operations. Conveyor gives low-cost processing as castings move in a steady stream from receiving through pre-heat, paint tank, and infra-red drying oven on way to storage. In storage area, operator transfers castings from conveyor to pallets. Fork truck then permits economical storage by tiering palletized castings to 16 ft and economical handling by moving castings to machines in large unit loads. Each type of equipment does the job on which it gives lowest cost

MACHINING: *layout achieves flexibility in line production*



Product-line arrangement turns out gears for 180 different transmissions. Parts move down center run, stop on outer sections. After machining, parts feed through 3-stage automatic washing unit built into line ahead of inspection and heat-treat operations. Four other lines are similarly set up

age area by fork trucks. A hydraulic dock plate is lowered to the platform of the truck as soon as it backs into the receiving well, making it possible to start the unloading procedure without delay.

Castings are fed onto a chain conveyor at the receiving dock and carried through painting into the storage area. There the castings are removed from the conveyor and placed on pallets—then the loaded pallets are stacked by a fork truck in the space assigned to that particular kind of material. This method saves much time and floor space and makes the material immediately available to be quickly and cheaply moved to the processing lines by the fork trucks when the material is needed.

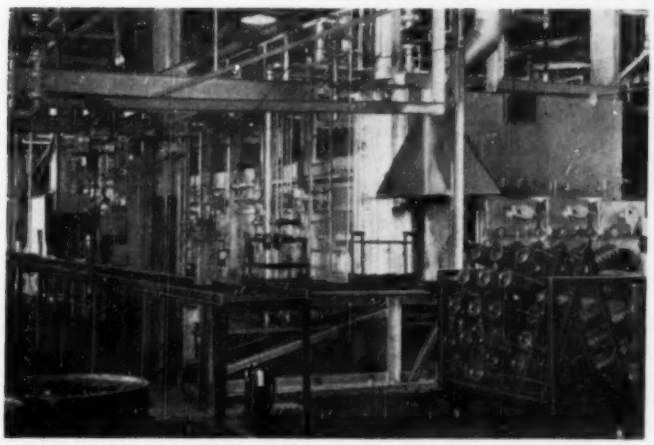
Product Lines Are Flexible

Particularly noteworthy is the fact that line manufacture has been achieved in a plant that is essentially a production job shop. Basically, the plant manufactures differentials and transmissions for trucks, tractors, and industrial trucks. But as many as 150 to 180 different models may be produced in a single month. To accommodate the full range of work, most machine tools are standard for quick, easy changeover. At the same time, as there is considerable variability in the operations required, it is particularly important that the manufacturing layout permit flexibility in machine routings.

This is provided in the over-all layout concept of the plant. Similar items are grouped for manufacture in product line. Two lines were set up for differential gears and three for transmission gears. Similarly, lines were set up for transmission cases: light, medium, and large heavy-duty. All items that did not justify product-line manufacture then were routed to a miscellaneous machine section.

Within the gear lines, flexibility is obtained by grouping machines according to operating sequence in work centers on both sides of a system of roller conveyors. Parts move down the center express-run of conveyor, bypassing those work centers in which they have no operation. Further, adequate space has been allowed between lines to permit truck operation should it be necessary on a special order to move parts between adjacent lines.

HEAT-TREATING: *furnaces are located in production line*



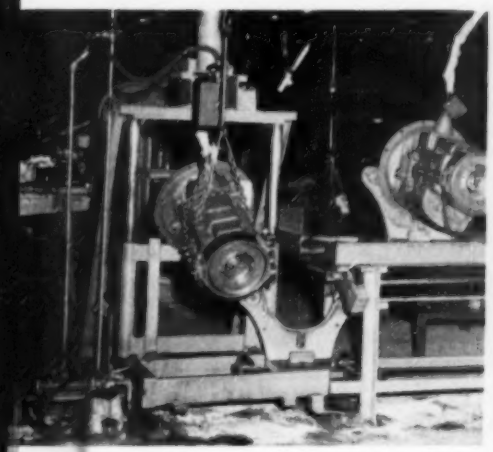
Controlled atmosphere furnace heat-treats precision gears at 750 lb per hr. Mechanization is nearly 100% as hydraulic cylinders push loaded dollies intermittently on pre-set cycle through 3-stage furnace, quench tank, wash station, and tempering furnace. One man loads dollies, second unloads and returns dollies on roller sections along furnace. Carburizing is at 1675-1700F

Washing Is in the Line

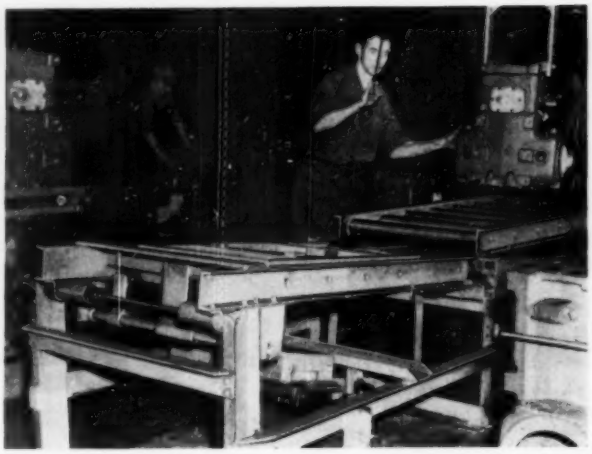
Of particular interest in these lines is that each has its own automatic washing unit with return conveyors looping around the unit to permit more than one trip through if necessary. Thus, several extra handling operations to accumulate parts in batches for transport to a central cleaning department have been eliminated. Parts come off the machining lines clean and dry.

Similarly, no separate central department has been set up for heat-treating. Furnaces are spotted directly in line with the machining conveyors and ahead of shotblasting, grinding, and lapping opera-

ASSEMBLY: *ingenious devices return fixtures to head of line*



Dolly return consists of section of conveyor that drops to lower level, as shown, when operator steps on pedal valve, lower left. As section hits bottom, it trips valve so piston of cylinder at left kicks dolly along lower conveyor



Pallet return consists of counter-balanced hinged section of roller conveyor. Empty pallet strikes tripping bar at end of section to release catches on swinging end. Section pivots under weight of pallet and gives pallet fast start down gravity return. Special grab speeds hoist operation

tions. Both transmission and differential lines have their own installations and thus there is no problem of hauling, cross-flow, and congestion as often occurs when parts feed to a single central department.

On the roller conveyer lines, three parts-carriers are employed for all operations prior to washing. These units are specially designed to provide maximum practical carrying capacity per running foot. At the washing operation, wire baskets are introduced and become the basic container for all remaining operations. These baskets are either 12×16×4 in., or 12×20×4 in. and their dimensions were determined only after considerable experimentation to find a size that would hold an appreciable number of parts yet would not be too heavy for easy handling. Actually, the smaller size is considered standard, with the larger intended only for several shafts that are too long for the smaller baskets.

Within the heat-treating sequence, mechanization is nearly complete, with parts moving by conveyor through carburizing, quenching, washing, and drawing units. Yet, flexibility still is present. For example, on the three-stage automatic carburizing furnaces a 24-in. door-opening plus time-cycle control permits a considerable variation in the physical size of parts that can be treated. Further, two stages can be run on one time cycle and simultaneously the third stage can be operated on a different cycle.

Following shotblasting, transmission gears move in special trucks to grinding and lapping operations. Conveyors then come into the sequence once more, as individual parts are hung on a trolley conveyor for movement through automatic washing to test stations. Accepted parts then move on special trucks to storage ahead of assembly.

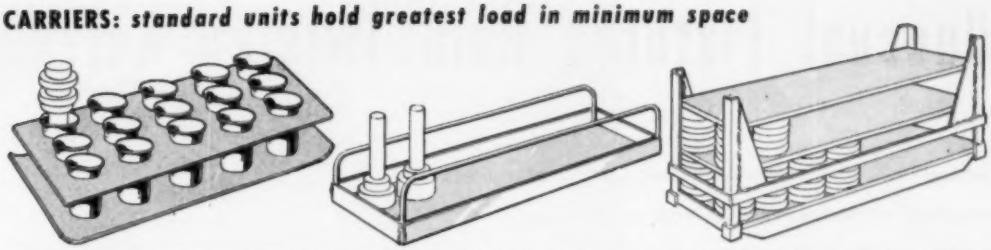
Trucks Are Adjustable

These trucks, although now commercially available, initially were designed to Clark specifications. One is a pin type which is employed chiefly to move gears from inspection to heat-treat and which eventually will be replaced; the other is a shelf truck which is used for the wire baskets and permits adjustments in shelf spacing in 1-in. increments. The shelf-truck wire-basket combination is considered the basic handling method for all batch handling of loose machined parts throughout the plant. The dimensions of the standard basket are modular with the truck shelf, 4 fitting one way, and 3 the other way. For convenience in operation, Clark has added a piece of light angle to the underside of the shelf about 1 in. from its edge. A cotter pin then is passed through the shelf edge and the angle beneath the supporting rod to lock the shelf securely in place. Trucks may be handled by fork truck if required.

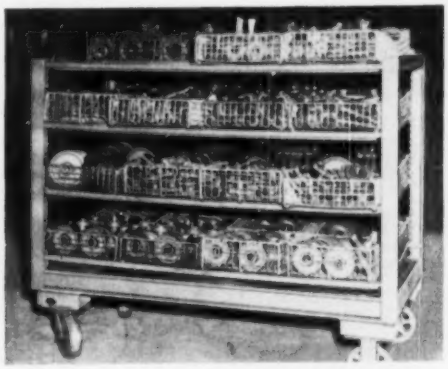
In the differential-gear layout, the basic handling scheme is the same, with roller conveyors, the shelf truck-wire basket combination and a trolley conveyor for washing after grinding and lapping. However, the major heat-treating method is pack carburizing, so the carburizing, quenching, washing, and drawing operations are not integrated into one mechanized sequence. The quenching and drawing operations require operators but the washing sequence is automatic with a trolley conveyor carrying parts through a controlled cycle and at the same time providing required storage space without loss of floor area by running at ceiling height.

A different handling plan is employed on the transmission case lines, where parts are bulky and

CARRIERS: *standard units hold greatest load in minimum space*



Parts-carriers for roller conveyors are specially designed to hold maximum practical number of parts per running foot



Hand trucks are of pin or shelf type. Latter plus baskets is basic method for unit-load handling of loose machined parts

heavy. Handling is primarily overhead with monorails and hoists serving the full length of the lines, plus jib cranes, and occasionally a gravity roller section between two machines. Close production control is particularly important on these lines, as orders for like units are grouped to give the maximum practical run per setup. Storage ahead of assembly levels off the difference between rate of production and use. In this area, as in incoming stores, palletizing and high tiering by fork trucks multiply effective floor area by permitting full use of building volume.

The miscellaneous machine shop is operated entirely on a jobshop basis with all material moving in bins by fork truck according to any routing required.

Assembly is progressive on roller or dolly conveyors with parts and sub-assemblies feeding in at the proper stations. After test, units are palletized for movement by fork truck to shipping and the loading dock.

TO SHIPPING: *fork trucks move assemblies in unit loads*

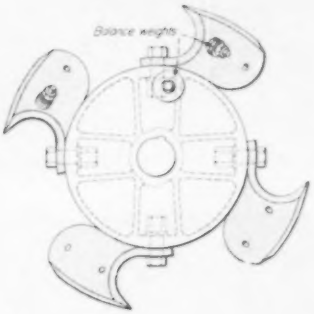
Palletized assemblies are carried by fork truck from end of assembly line to Shipping and on into highway truck. Dock facilities are similar to those in Receiving

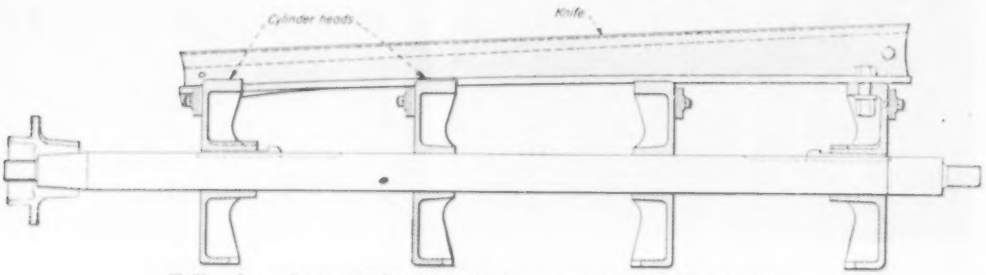
Another interesting feature of the plant is the method of supplying coolant to the machines. Coolant is mixed in large tanks located at several points througout the machining area. It is then pumped to hoses hanging over the roller conveyors. Coolant buckets can be filled on the conveyor, then moved along to the proper machine with little effort required from the operator. Spaced at regular intervals along the line, hoses make coolant readily available at all times.

Unusual Fixtures Hold Twisted Knives

Helical twist of forage-harvester knives, plus accurate machining required, adds up to a tough holding problem. These fixtures suggest methods for handling work of heavy, curved design

BY W. H. LANG, Supt., Machine Shop
La Porte Works, Allis-Chalmers Manufacturing Co.





Knife edges of assembled cutter cylinder must be concentric with shaft bearings to within 0.005-in. total indicator reading. First cylinder heads and later knife blades are balanced with washer and bolt weights at 1700 rpm

Mounting-bolt holes must be radial with axis of cylinder. Knife is clamped in lower section of fixture. Drill spindles, at proper angles, are fed through quills by movement of upper fixture section through rack and pinion. Mounted in column drillpress, entire assembly can be removed for other work

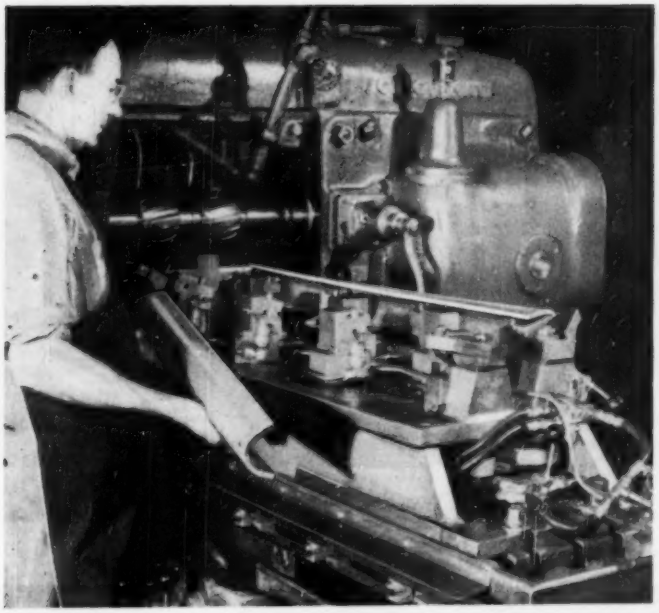
ACCURACY of location is of prime importance in machining blades for forage harvesters. The helical twist given each blade before machining requires some tricky fixture design.

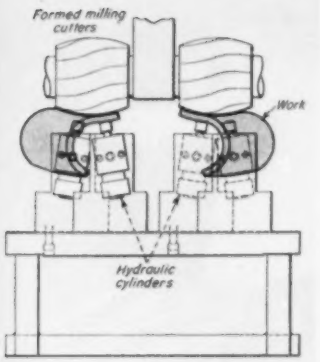
Fortunately, none of the operations involve heavy cuts, and the heavy section of the blades makes them relatively stiff, so that heavy clamping pressure is not required.

The four-bladed cutter cylinders look like rotating reels for oversize lawnmowers. Each blade is hot-formed from a $5\frac{5}{8}$x36x$\frac{3}{8}$-in. cold-rolled bar of fine-grain C-1019 steel.

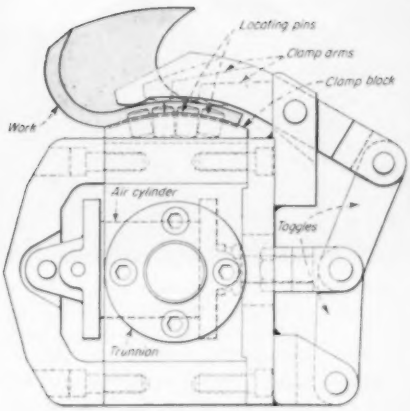
Two holes drilled in the flat first locate the work in the forming die and later serve to hold balance weights. Four mounting-bolt holes are drilled after forming. Mounting spots and clearance on the blade edge are milled. After hardening, the blades are mounted, cutting edges are ground, and the assembly is dynamically balanced.

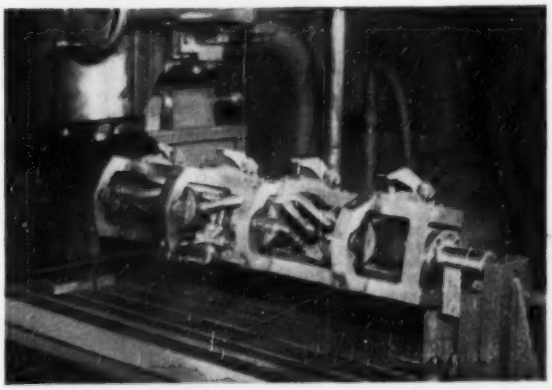
Pictures on these pages show the unusual fixtures required for these operations.

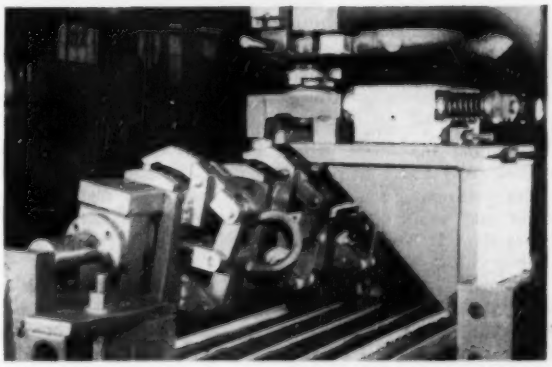




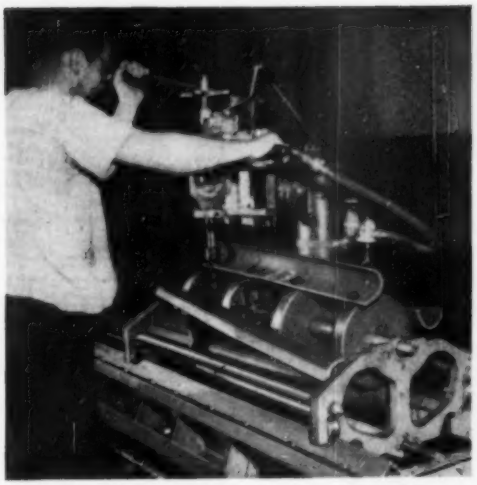
Mounting spots are milled on two knife forgings on automatic-cycle rise-and-fall milling machine. Four hooked locators, operated by air cylinders, lock blades in position against hardened blocks. Hydraulic jacks under each milling position are operated at 50 psi and controlled by a single valve. Two 4.5-in. radius formed cutters, 3.5-in. dia cut at 63 rpm, feed of 3 ipm





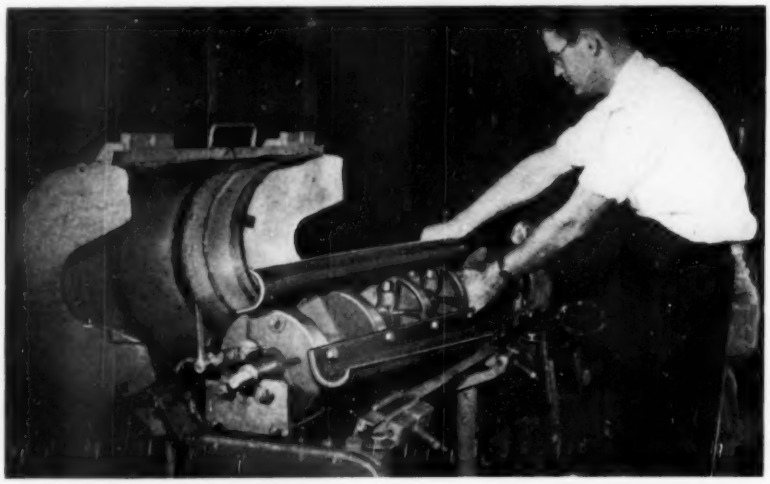


Clearance angle of 27° along cutting edge of knife blade is cut with a 4-in.-dia carbide face-milling cutter. Part is located on pins which enter drilled mounting-bolt holes before air-operated clamps are closed. Pressure rolls flanking cutter and backup shoe cause blade to turn on trunnion mounting as table is traversed. Air-operated clamp arms are of different lengths to suit location of clamp positions along blade



Pneumatic nut runner tightens mounting bolts after blades are carburized to 0.020- to 0.025-in. case depth, then oil quenched to hardness of 58-62 Rc. Carriage is traversed along rails to locate bolts under driver

Assembled cutter cylinder is cylindrically ground. Grinder is equipped with special steadyrests. Wheel has 36-in. dia with 4-in. face



Balancing machine with capacity for work to 35-in. dia is used to balance assembly dynamically at 1700 rpm. Bolts and washers serve as weights to bring assembly into balance

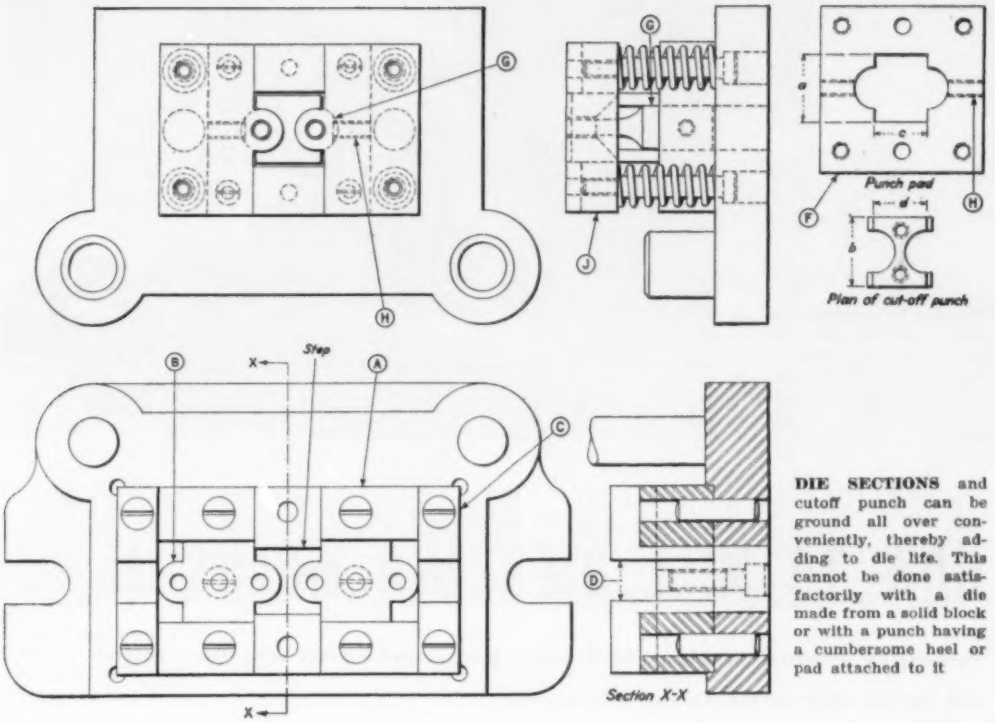
THE BEST WAY TO FIND OUT IS TO ASK

OLD CHARLIE TAHELL has a garage out behind his house where he whiles away many an hour of his retirement among tools and equipment that would grace any one-horse shop. He's working on some sort of milling attachment now.

"Y'now," sez Charlie to me one day, "this attachment is going to be a hum-dinger if I ever get it finished. Trouble is I keep thinking of new ideas to add to it. Then I have to tear it down again so I can add 'em. The project ain't movin' as fast as it oughto, but every new idea seems worth the trouble it takes to add it."

Old Charlie is shooting at perfection, and if he lives long enough, he'll make it. That brings up an important point in design philosophy. We must stick to the policy of creating the very best we can.

Plenty of manufacturers could profitably take their new designs, make pilot working models, and try them out in the field. Let the oldtimers look them over, and damn them, but get some kind of criticism. Take an oldtimer's ranting and raving about a new, different product or piece of equipment, subtract his reluctance to accept change, and you have left some pretty good ideas. *John Homewood, Ontario, Calif.*



DIE SECTIONS and cutoff punch can be ground all over conveniently, thereby adding to die life. This cannot be done satisfactorily with a die made from a solid block or with a punch having a cumbersome heel or pad attached to it

Reversible Die Sections Mean Economy

BY ARTHUR WALTER

DOWNTIME for die repair on heavy production runs can be a serious matter. The die designer can avoid much trouble by thinking in terms of interchangeable, reversible die sections and punch components that are quickly and cheaply replaced. Here is an example of a tool that has given good service when piercing and cutting off stock up to 3/16 in. thick, but the principles involved can be applied to other operations:

Die Details . . . Side rails *A*, die section *B* and end rails *C* are sunk into the die shoe and are mutually self-supporting. The two identical die sections are double-ended. If one is chipped or broken, it can be reversed and production continued. Accurate spacing of the die sections is accomplished by the step on each side rail.

Adjustment screws in the end rails keep the die sections against the steps.

Section *X-X* shows that the side rails have a central step to act as a backup for the cutoff punch, which thus needs no heel. And opening *D* in the end rails acts as guide for bars or angles.

Punch Details . . . As all tool engineers know, it is difficult to design a good solid pad that is not part of the cutoff punch, when the piercing punch is placed close to a cutting edge. But the combination of a pad and cutoff punch is expensive, and a lot of money is quickly lost if the punch is broken or chipped. This is the way individual parts can be assembled:

Longest opening *a* of the punch pad *F* is made a snug fit to dimension *b* of the cutoff punch. Dimension *c* of the pad corresponds with dimension *d* of the punch. Hence, at assembly, truly circular openings are provided for insertion of the piercing punches *G*. Tapped holes *H* in the pad provided for setscrews to enter whistle slots in the piercing-punch shanks, so the punches will not pull out.

Two tapped holes in the top of the cutoff punch hold it firmly. The conventional spring stripper plate *J* is mounted on the cutoff punch.

Spare die and punch parts can be made for this die at low cost.

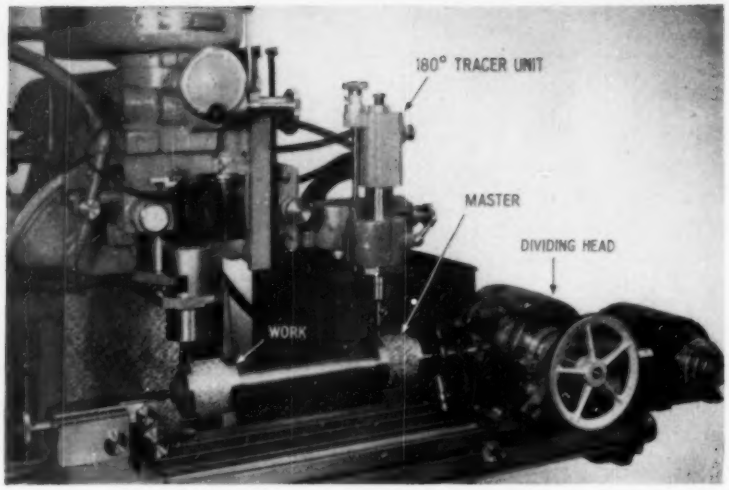


Fig. 1.. Decorations on an embossing roller for lace paper are produced by rotating the master and work with a dividing head and using a vertical milling attachment and 180° tracer unit

HOW TO MILL DIES AND MOLDS...II

Patterns on cylinders, flat blanks, bowl-shaped pieces can be milled with tracer controls and various other milling-machine attachments.

External and internal surfaces can be profiled with the 360° profiling tracer unit

BY MARIO MARTELLOTTI, THE CINCINNATI MILLING MACHINE CO.

Setup to Mill Embossing Rollers

TO REPRODUCE designs on the surface of rollers for embossing paper, leather, thin metal, etc., the following procedure is utilized:

The blank and master are rotated simultaneously by mounting them on a mandrel, Fig. 1, inserted between centers of a dividing head and tailstock, mounted on a plain knee-type milling machine with vertical milling attachment and 180° depth-control unit (*AM*—May 15, 1950, p 118).

The index plate is removed, and a pulley is mounted on the dividing-head worm shaft. The spindle of the dividing head is then driven by a fractional-horsepower motor through a four-step sheave at a speed sufficiently low for the die-sinking operation. Progression for the cut is obtained by feeding the table of the machine at a slow rate. A fine-point tracer and a corresponding single-cutting-edge cutter are used to reproduce the fine decorations.

Right- and Left-Hand Molds and Dies

MOLDS for plastics and dies for die castings and drop forgings, which are required for right- and left-hand articles identical except for a change of "hand," may be made by using the reverse-image attachment. With this attachment, Fig. 2, both right- and left-hand molds or forging dies can be made from a single master of either hand.

The principle of the attachment is to reverse the movement of the master with respect to the die blank. If the table moves to the left, the master is moved to the right, and vice versa.

Example: Milling a forging die for a left-hand golf iron, using the master for producing the die for the right-hand iron.

Procedure: The die-sinking operation, Fig. 2, is performed by feeding the machine table and progressively cross-feeding the saddle by small increments after each pass. A milling machine especially designed for work on small and medium size dies is used and the machine is equipped with a hydraulic depth control or 180° tracer unit. The master is clamped on

Abstracted from "A Treatise on Milling and Milling Machines," soon to be published.

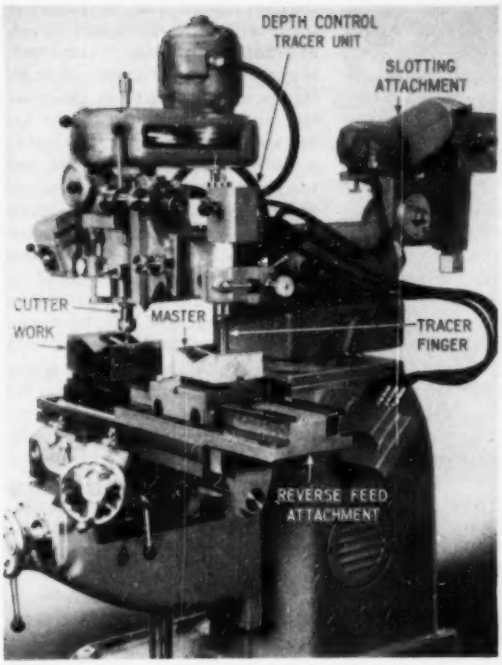


Fig. 2.. Milling a reverse-image forging die is done with a reverse-image attachment fitted to a hydraulic depth-control machine

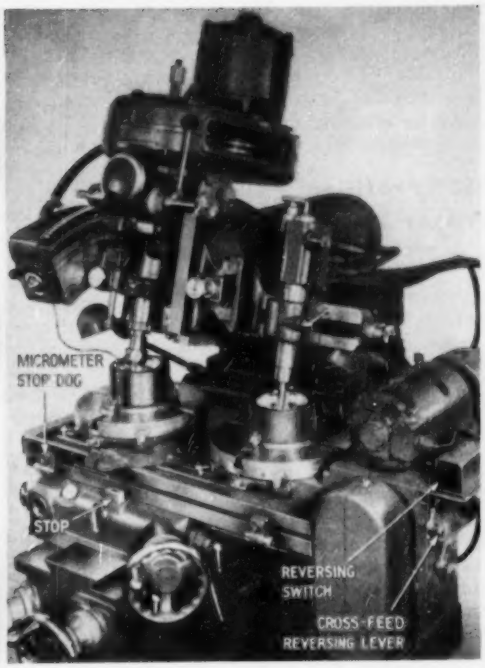


Fig. 3.. To mill a mold for a glass bowl, the machine is equipped with a duplex rotary table attachment and crossfeed drive

the table of the reverse feed attachment.

The same machine can also be used for straight milling operations by detaching the entire tracer mechanism from the spindle carrier without disconnecting it from the hydraulic unit. A bracket on the right-hand side of the column, Fig. 2, carries the tracer mechanism when it is not used. With a handle the cutter spindle can also be operated as a sensitive drill for drilling operations. By swiveling the upper structure of the machine, the slotting attachment can be placed at the front to perform slotting or shaping operations.

Milling and tracer heads can be tilted toward the front or rear of the machine, as required. When this method is used, it is essential that the master and work be located at the same height. Tilting of the spindle and tracer heads, as previously described, is particularly useful when milling reentrant corners or grooves in dies or molds.

Decorative Designs in Molds

To work out molds for glass dishes and decorations for embossing dies, even internal and external work on round or flat blanks, the duplex rotary-table attachment is useful. This device can be set up on a hydraulic, depth control milling machine, as shown in Fig. 3. Simultaneous rotary motion of the master and die or mold blank, is provided by the attachment, in conjunction with the cross feed of the machine saddle.

For example, it may be necessary to reproduce a die which, in addition to a decorative design on either a flat or curved surface, has sunken or relieved portions, or openings with extremely steep sides. To reproduce such a die by the rotary attachment, it would be necessary to fill in the cavity, plug the openings, and reduce the steepness of the relieved portions while working out the decorations. Later, these portions can be worked out by the regular die-sinking or depth-control method.

Controlled by a reversing switch, the two rotary tables are simultaneously driven either clockwise or counter-clockwise at from ¼ to 5 rpm. Hand operation of the rotary tables by means of a crank can also be used.

In addition to driving the rotary tables, the motor, through a properly arranged mechanism, drives the machine saddle at a rate of feed which may be varied in four steps between limits of 0.0016 and 0.060 in. per rev. of the rotary tables. The saddle can be selectively fed towards or away from the machine column by means of a reversing lever, regardless of the direction of rotation of the rotary tables.

When the duplex rotary-table attachment is used, the machine table is locked in position by the table clamps and two opposed micrometer stop dogs, set against a

stop projecting from the table housing.

Hand cross adjustment of the rotary tables can be made at any time with the cross-feed handwheel by releasing the brake on the cross-feed leadscrew.

360° Profiling Tracer Unit

TO MILL complicated contours of the types frequently found in dies for blanking, piercing, forming and other stamping operations, where the die contour may be reproduced by profiling, the 360° tracing mechanism, Fig. 4, is employed. This unit is supported by a bracket on the right-hand side of the vertical head of the machine.

The 360° profiling mechanism correlates table and cross-slide movements of the machine so that the cutter, mounted on the spindle of the vertical head, will accurately duplicate any movement of the tracer finger, as determined by the master or templet held on the machine table. The tracer finger is connected to a handwheel, and can be rotated with it. This connection however, permits free angular displacement of the tracer with respect to the handwheel axis.

The handwheel is provided with arrows on each of the two spokes, pointing in the same direction. The arrows indicate the direction of relative movement between the tracer and master, and the cutter and work, respectively, resulting from the combined movements of the two slides.

When the arrows are set parallel to one slide, this slide is feeding, and the other is stopped. The conditions are reversed when the handwheel is turned 90°.

Table and cross-slide movements can be obtained by hand operation or automatically, as follows:

1. Hand operation, by manual rotation of the handwheel, is used when guiding the cutter in preliminary adjustments and setting the cutter and tracer in position for the cut. Hand operation is frequently used to remove excess stock by hand steering, keeping the tracer finger clear of the templet. It is also used when clearing the cutter and tracer after finishing the cut.

2. Automatic operation is obtained by deflection of the tracer finger when brought into contact with the master or templet. Hand control is automatically disengaged as soon as the tracer finger contacts the templet.

When the handwheel is viewed from above and rotation is in a clockwise direction, the tracer finger will always feed around external templets in a clockwise direction, and around internal templets in a counter-clockwise direction. These directions are reversed when the handwheel rotates in a counter-clockwise direction.

When the tracer finger is not in contact with a master or a templet and the control valve is in automatic position, the handwheel rotates steadily and no movement of either slide occurs.

To engage the tracer with the templet or master, the control valve is placed in the hand-operation position. In this case, automatic rotation of the handwheel will stop and hand rotation can be used to guide the tracer in contact with the master.

When contact with the master or templet deflects the tracer finger, automatic operation is resumed; the table and cross-slide will move the cutter and tracer in the relative direction indicated by the arrows on the spokes of the handwheel. Corrective action of the tracer in contact with the master will then determine the relative motion of the slides so that the contour of the templet or master is reproduced on the workpiece.

To profile around the pattern on a complete cycle of 360°, the tracer finger is eccentrically located with respect to the axis of the tracer arm or spindle by adjusting the eccentricity of the tracer-finger holder relative to the tracer arm. This eccentricity of the tracer finger together with tracer rotation are the means which accurately direct the milling cutter around the work in the path determined by the shape of the pattern.

Amount of tracer finger eccentricity is determined by the tracing conditions. Heavy cuts and fast feeds will usually require greater eccentricity than light cuts and fine feeds. Greater eccentricity will enable the tracer better to follow changes in contour at high profil-

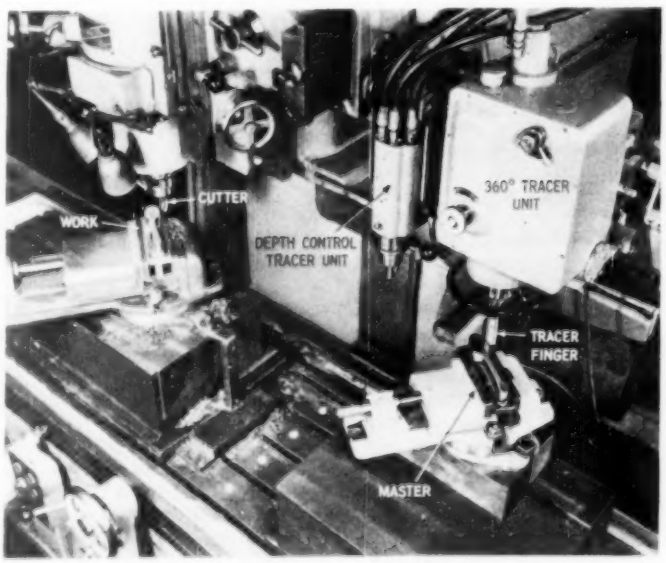


Fig. 4.. Complicated contours, as on dies, may be reproduced by profiling under the guidance of 360° profiling tracer

ing rates, while a smaller amount of eccentricity will insure accuracy of reproduction. The latter is desirable when fine details are to be produced in the finishing operation.

In 360° tracing, the size and relationship of the cutter and tracer are the same as in depth control tracing, and can be determined by means of formulas given in the previous installment (*AM*—May 15, 1950, p 118).

Profile Milling of Rectangular Holes

MILLING twenty rectangular openings in an aluminum ring, Fig. 5, constitutes an example of use of the 360° profile tracer attachment on a Hydro-Tel vertical milling machine. The templet of the cavity is held on an extension table clamped to the machine table. The workpiece is clamped on an index table which is used to index the openings in position for the cutter. Templet and workpiece are aligned by placing pointers in the machine spindle and in the tracer-finger holder.

The finger holder is first set to zero eccentricity. After completing the setup, the eccentricity of the tracer-finger holder is set for the required value.

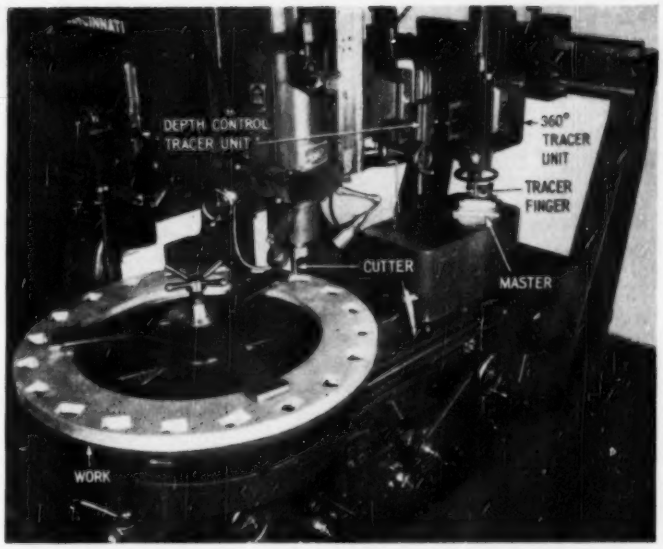
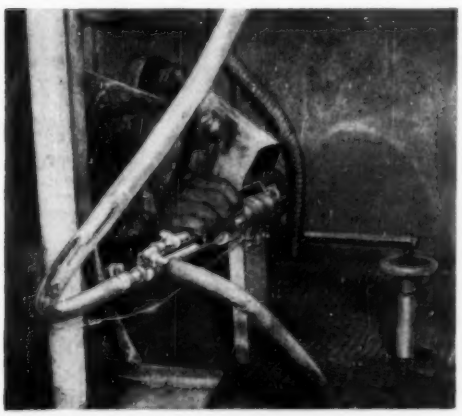
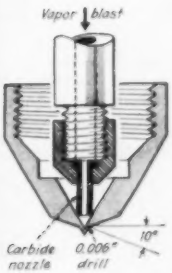


Fig. 5.. Profiles of openings in a workpiece, in this case 20 rectangular holes in an aluminum ring, are accurately milled both as to size and location through the combination of a 360° tracer control and an indexing table clamped to the machine table

After the first hole is milled, the cutter and tracer finger are cleared from the workpiece and master, respectively, to permit indexing the second hole into position. The tracer is then lowered into position to resume the milling operation by bringing the tracer into contact with the master.

Direction of tracing is selected from the method of milling desired. When viewed from above, the rotation of the handwheel should be clockwise when up milling and counter-clockwise when down milling.





Deburring is done in sandblasting booth (above, left) where air and water-abrasive mixture are fed into diesel-injector cup separately. Cleaning takes only a few seconds, little abrasive. Spray holes (above, right), spaced radially around the cup, are drilled at 28,000 rpm before deburring

Carbide Nozzle Directs Deburring Vapor Blast

ANOTHER USE for abrasive-resistant carbides is in diesel-engine manufacture. Injector cups for Cummins engines are drilled at their tips to form seven tiny holes. After a number of different tryouts, the best method for deburring was found to be blasting a mixture of water and No. 625-grain abrasive through them with 90-psi air.

Tungsten carbide is formed into small nozzles with only a 0.056-in. ID, a 0.093-in. OD, and a small flange. These are fitted to nozzle holders which connect to the abrasive supply.

POINTERS FOR BETTER FORM TOOLS

BY HERBERT C. LINDBERG

Break Down the Operation

Correct interpretation of tolerances is often overlooked. On any multiple-spindle automatic job, the secret of mass production is to get each tool to do an equal amount of work, and thereby achieve maximum efficiency. For instance, Figs. 1 and 2 show how work is divided among tools, a principle that can be extended to far more complicated parts.

The layout in Fig. 1 is superior for holding close tolerances, because all dimensions are controlled by the one form tool. But maximum production is not obtained, because 245 rev are required for forming. In Fig. 2, the form tool handles two diameters, and the smallest diameter is turned, reducing the revolutions more than one half. So, sometimes you must sacrifice tool-design principles to production needs.

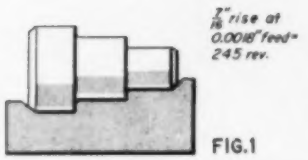


FIG. 1

Slow . . . Closer tolerances can be held by machining all diameters with one form tool, but output suffers

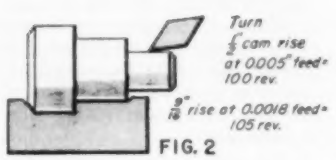


FIG. 2

Much Faster . . . By turning the smallest work diameter and using a form tool for the other two diameters, forming time is reduced almost 60%

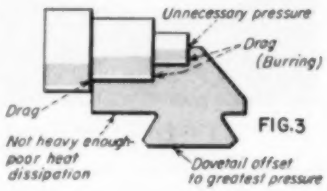


FIG. 3

Poor Design . . . Straight tool edges at shoulders drag and burn. Dovetail is not opposite maximum thrust

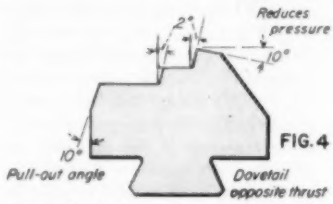


FIG. 4

Good Design . . . Tapered tool faces and 10° clearance reduce pressure and eliminate drag. Husky tool with centralized dovetail provides rigidity needed for accuracy and finish

Roughing Form Tools

From my observations, the circular form tool is superior to the flat form tool for roughing operations. Greater tool life, rigidity and ease of setup favor the circular type. Bear in mind these points when designing them:

1. A rougher is what its name implies. Design should be simple. Eliminate little chamfers.

2. Avoid straight faces and shoulders, Fig. 3, because the chances are that the tool will burn or drag. Instead, taper the tool faces from 2° to 5°.

3. Provide a finishing allowance of 0.010 in. on diameters and 0.005 in. on shoulders and face widths.

4. On the cutoff side use a pull-out angle of 10° to prevent the cut-off tool from burning or digging into the stock. It is good practice to make the cut-off end 0.010 in. wider than the cutoff tool itself.

5. If a dovetail rougher is used, centralize the dovetail with respect to the pressure of the cut, Fig. 4.

6. If a flat tool is used, make certain that it is sufficiently rigid to handle the hogging work expected.

7. Select the rake angle according to material. A 10° rake will suit the majority of parts.

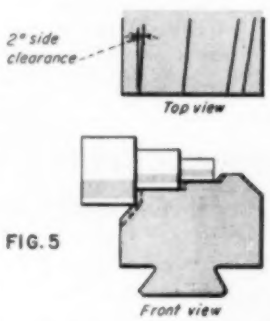


FIG. 5

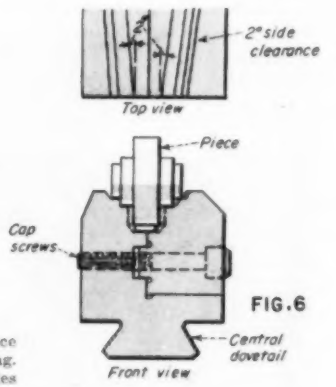


FIG. 6

Side Clearance . . . A 2° side clearance prevents straight tool edges from burning. If locations of straight sides on both sides of a shoulder must be held, use a split tool

Finishing Form Tools

These tools are made to the exact shape or section of the part. If rake angle is put on the cutting edge, calculate the change in form.

If the part has deep shoulders, use a 2° side clearance, full length, on flat form tools. As the tool is

Too often, basic principles in form-tool design are overlooked. Success or failure in multiple-spindle operations depends on correct usage of the principles that the author points up with examples

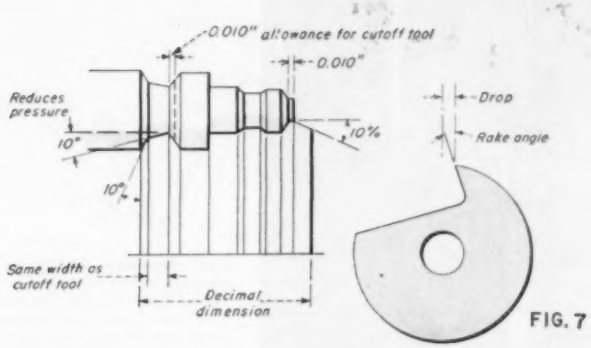


FIG. 7

Form Tool Dimensioning . . . Work dimensions from one side of the tool or a baseline. Notes on the sketch show construction features that eliminate burning, reduce side pressure and assist cutoff

sharpened it must be reset to compensate for gradual tapering to the back, Fig. 5.

The above type of tool will control all straight edges on one side of the part. But if straight sides must be produced on both sides of a shoulder, it will be necessary to use a split tool, Fig. 6. When the tool is sharpened, remove the holding screws and regrind the mating surfaces, to compensate for increase in width of the cutting faces.

If a shaving operation is to follow finishing, allow 0.005 in. on the diameter for the shaving operation.

Drawings That Help Toolroom

Tool drawings should express all dimensions in decimals. Bear in mind that if one tool is taken out for resharpening, another tool must be inserted in its place with minimum downtime and adjustment. Specifically, the rules for dimensioning, Fig. 7, can be expressed thus:

1. Dimensions in decimals should be worked from one side of the tool or baseline. Exception: the part may have dimensions expressed in such a way that a similar dimensioning method must be used for the tool. But even in this case, the dimensions can be tied in decimally to a baseline.

2. Allow a 0.010 in. extension on the cutoff side of the form tool to permit the cutoff tool to maintain proper relationship to the part.

3. Employ a 10° pull-out angle to clear the stock and prevent burning or dragging.

4. Put 10° clearance on the outside and cutoff ends of the tool to reduce side pressure.

5. If possible, stamp or etch the tool material, tool number, and rake angle on the tool to prevent errors when resharpening.

The same rules govern design of semi-finishing tools.

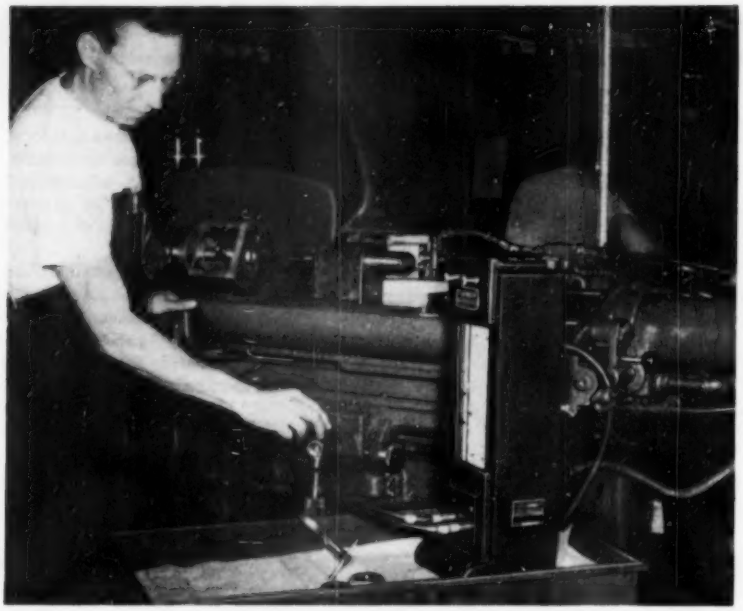
Tips FOR TOP SHOP MEN

339 Take a man's pride in his job away, and there isn't much left; he becomes another automaton. Even a trained seal enjoys the applause as much as he does the fish.

340 When you walk the tight-rope between close tolerances, or between good and bad finish, balance is vital. Be sure you have it, in machine-tool spindle or shaft, in tooling, in fixture. It will pay out in longer tool life and reduced scrap.

341 Do you know just what you have in material and equipment inventories? If you don't, you'll drop more dollars than you think. It isn't necessary to know how many peanuts there are in the barrel (as one store clerk attempted to discover) but you must know how many barrels, and how rapidly one is used up.

"Okay, Joe, you can come out now, the big boss has steamed on into the next department."



Two-dimension spindle on air gage shows up tool condition by indicating bored diameters. Inspection utilizes otherwise-wasted operator time while machine is working on the next valve

On-The-Spot Inspection Controls Valve Scrap

BY J. R. BLY, Chief Inspector, GENERAL CONTROLS CO.

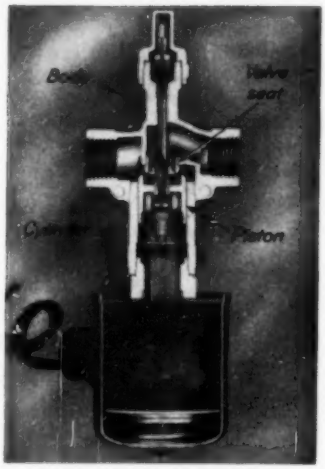
CURRENT inspection, as opposed to inspection records, means that a machined product is checked immediately; not after a batch of parts have been completed and sent on to a central inspection department. Nobody collects scrap history at General Controls when K-15 valves are being bored because the operator has a Sheffield Precision-aire gage set up to give readings on size, roundness, and taper of the hole while a new part is being turned out.

Inspection is therefore no more than one piece behind the machine, and the operator can watch sizes drift with tool wear and can make periodic adjustments to keep within his established limits. On original setup, the operator has a better idea of what he is doing, and can stop scrap before it starts by making immediate tool adjustments—as indicated by readings on the first piece from the boring machine.

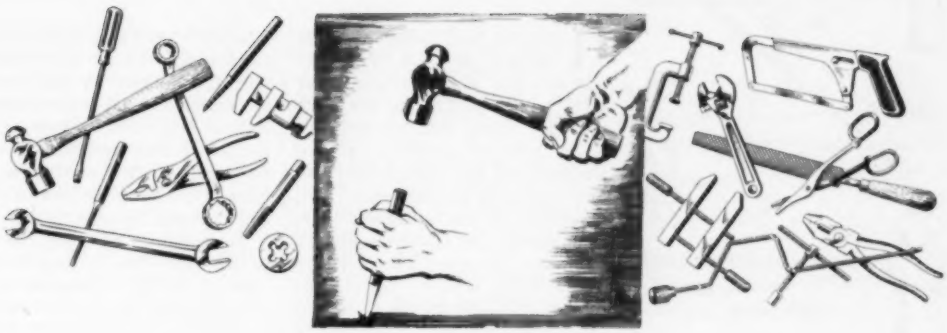
For the valve job, selective fitting was ruled out because of (1) expense and (2) the need for good service-replacement fits in ten or fifteen years. This meant that inspection had to be accurate and quick. The double-column gage with a double-jet spindle shows results of a single-tool boring job that cuts cylinder bore, main port-seat bore, and port-seat face.

Two other boring cuts are air-gaged, too. The seat for the pilot-port insert and the bore for the plunger tube are checked in a similar manner. Depending on lot size, an economical method of gaging these surfaces is selective inspection by batch; which calls for holding bad parts for salvage.

Air gaging, as a method for economy, not only reduces scrap and reworking, but also assures uniform and immediately controllable machine operation.



Valve body is fitted with silver-soldered bonnet and cylinder, press-fitted monel port seat; then bored in one machine setup



Know Your HAND TOOLS

BY H. E. LINSLEY
ASSOCIATE EDITOR

HAND TOOLS, like women, usually have the last word. And, as in war you may destroy the enemy by long-range guns and bombs, but must still have infantry to hold your gains, so in industry you may manufacture your product with machine tools, but must still have hand tools for final assembly and adjustment.

What are the various kinds of hand tools? What do they look like? How, and when, and where do you use them? How do you take care of them? The answers to these and other questions are in this Special Report.

To the well-trained mechanic, this is all old stuff, for these are the tools of his trade, the symbols of his craftsmanship—and worthy of this review. To the newcomer in industry, the apprentice and the student, here is a wealth of information not readily available in standard texts. This information may save you, and your employees, both time and money in damaged tools, damaged work, and, most important of all, damaged bodies.

A SPECIAL American Machinist REPORT TO THE METALWORKING INDUSTRIES

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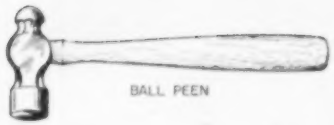
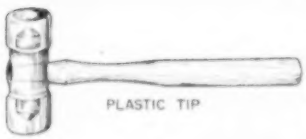
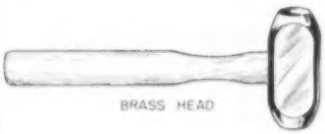
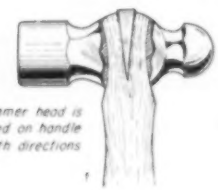
MACHINIST'S HAMMERS









HAMMERS are designated according to their weight — without the handle — and their style, which varies with the work they are to do. For the heaviest work, there are several weights of sledges used for blacksmith work and for some big assembly jobs, but these are not considered here. Commonest style is the machinist's ball-peen hammer. The flat end of the head, used for most hammering, is called the face, and the other end the peen, used chiefly for riveting. The hole for the handle is the eye.

Variations of this are the straight-peen and the cross-peen. Usual weights are 4, 6, 8, and 12 oz, and 1, 1½, 2 and 2½ lb. For most work a 1½- or 2-lb. hammer will suffice, but it is well to have one or two smaller ones for light work such as layout.

When there is danger of damaging the surface of the work, use a special hammer, with a head made from brass or lead, or from a tightly rolled strip of rawhide. Lead, of course, quickly becomes battered and must be replaced frequently, but has the advantage of striking a solid, heavy, non-rebounding blow that is useful for such jobs as driving shafts into or out of tight holes. Plastic-tipped hammers, or solid plastic with a lead core for added weight, are becoming increasingly popular, particularly for use on aluminum and similar materials.

If a special hammer of this kind is not available, protect the surface to be hammered with a piece of soft brass, copper, or hard wood.

How to Use Them

Simple as the hammer is, there is a right and wrong way of using it. The commonest fault is holding the handle too close to the head. This is known as choking the hammer, and reduces the force of the blow. It also makes it harder to hold the head in an upright position. Except for light tapping, hold the handle close to the end to increase the lever arm and produce a more effective blow. Try to strike the object with the full face of the hammer. Hold the hammer at such an angle that its face and the surface of the object being hit will be parallel. This distributes the force of the blow over the full face and prevents damage to the edge.

The handle must always be tight in the head. Never work with a hammer having a loose head, because the head may fly off and cause serious injury. The hole in the head is slightly tapered both ways from the center. The handle is tapered to fit the lower portion, and a steel wedge is then driven into the end to expand it into the upper taper, thus wedging it in both directions. If the wedge loosens in use, it should be driven in again immediately, or replaced with a slightly larger one. Wooden wedges are sometimes used, but steel is better. Never use a makeshift such as driving a nail alongside the wedge.

A hammer handle should be made of ash or hickory, and should be used only as a handle. Don't use it for bumping parts in assembly, and never let it serve as a pry bar. Such abuses will cause it to split, and a split handle can produce bad cuts or pinches. When a handle splits or cracks, don't try to repair it by binding with string or wire—fit a new one.

If the head becomes chipped, throw it away. Once chipped, it is almost certain to chip again, and the flying fragment may easily cost you or your neighbor an eye. And in any event the jagged edge may mean a nasty cut if the hammer slips and hits your hand.

Don't try to make the hammer do all the work — put some muscle behind it. But adjust the weight to the job — light hammers for light work, heavy hammers for heavy work. Most important trick in using a hammer is to keep the eye on the point or edge of the tool being hit, not on the head. Give a light tap to get the range, and then swing.

OPEN-END AND BOX WRENCHES

SOLID, non-adjustable wrenches with openings in each end—called open-end wrenches—are the most widely used. Commonly furnished in sets of about 10 wrenches, they have openings from 5/16 in. to 1 in. in width. Larger and smaller sizes are, however, available.

The size of the opening determines the wrench size, which refers to the distance across the flats of the nut or bolt, and not to the bolt diameter. Actually, openings measure from 0.005 to 0.015 in. larger than the nominal size so they slip easily onto the nuts. When there is an opening on one end only, the tool is called a single open-end wrench. Sometimes also the handle is bent into a letter-S shape, and the tool is then called an S-handle wrench.

The smaller the openings, the shorter the over-all length. This proportions the lever advantage to the bolt size and prevents stripping the thread or breaking the bolt when the wrench is properly used. Strength is similarly proportioned so a properly made wrench will stand all the pressure a man can apply with his unaided muscles.

The head and opening are set at an angle to the body—usually 15°, sometimes 22½°. Turning the wrench over after each partial turn reverses the angle on the head so the next pair of flats can be engaged. A hex nut can thus be turned when the angle of swing is limited to as little as 30°. Special types have the head opening at 75° and 90°, and the other special types have extra-long handles or are made extra thin.

Box Wrenches

Extremely popular because it can be used in close quarters, the box wrench completely surrounds the nut and cannot slip off. Modern 12-point wrenches have 12 notches arranged in a circle, instead of a simple hexagonal opening, which permits continuous operation with a 30° swing. For square nuts, 8-point wrenches are available. Because its walls are so thin, it is ideal for nuts which are hard to get at with an open-end wrench.

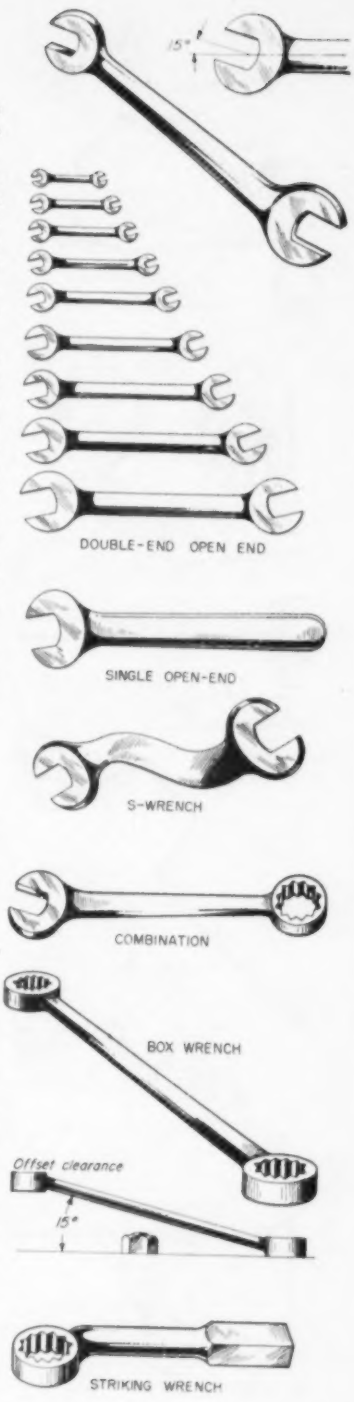
In addition to the straight type, some styles have the heads set at 15° to the handle to provide clearance for the user's hand. Special wrenches are also made with an offset on one or both ends to provide clearance for obstructions in the working space.

One disadvantage is that, while they are ideal for breaking loose tight nuts or pulling tight nuts tighter, they waste time when used for turning the nut right off the bolt. This is because the wrench must be lifted off the nut, then placed back on in another position unless, of course, there is room to swing it completely around. After a tight nut is broken free it can be removed more quickly with an open-end wrench. For this reason a combination wrench is often preferred—a box wrench on one end, and an open-end wrench on the other. This type is sometimes called a half-and-half.

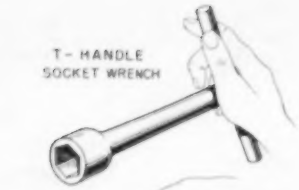
Hints on Using

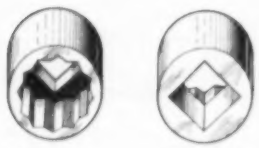
Always select a wrench that is a good fit on the nut. A loose wrench may break down the corners of the nut when a hard pull is applied, and the sudden release may cause a serious accident. Always pull on a wrench—never push. Pushing is dangerous because if a nut breaks loose unexpectedly you are almost certain to get skinned knuckles, and you cannot push hard enough to tighten a nut properly. Sometimes the only way the wrench can be worked is by pushing. In this case, push with base of the palm and hold the hand open.

Never use a piece of pipe to obtain additional leverage, never use a wrench as a hammer, and never hammer the end of a wrench. One exception applies: For extremely heavy work, special "striking" or "slugging" box wrenches are made with a short handle and a pad on on which hammer blows are struck.

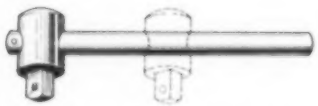


SOCKET WRENCHES AND ACCESSORIES



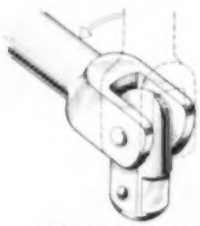


SOCKET



SLIDING OFFSET HANDLE

UNIVERSAL JOINT



HINGED OFFSET HANDLE

FEW TOOLS have saved more time and effort at assembly than the socket wrench. Early models had square or hexagon sockets integral with a T- or L-handle, but up-to-date types are made in sets which can all be used on the same handle and are 8- or 12-point, although 6-point may be used for extra-heavy duty. The end of the socket opposite the nut opening usually has a square hole into which the handle fits. A spring-loaded ball on the handle snaps into a groove in the socket (or vice versa) to prevent it from falling off. Sockets are usually furnished in sets for a range of different size nuts, and the sets are available in four classes designated by the size of the square on the drive end. Standard sizes are $\frac{3}{8}$, 7/16, $\frac{1}{2}$, and $\frac{3}{4}$ in., the larger sizes being designed for heavier work and larger size nuts. For extra-heavy duty, a 1-in. size is available.

For extremely close quarters, extra-thin-wall sockets may be obtained, but their use is not recommended for all-around work.

For most work, a ratchet handle is used to turn the socket. This has a reversing lever which operates a dog inside the head of the tool. Pulling the handle in one direction causes the dog to engage in the ratchet teeth and turn the socket. Moving in the opposite direction, the dog ratchets over the teeth, permitting the handle to be backed up without moving the socket. This makes for extremely fast operation, as the socket does not have to be removed from the nut with each partial turn. With the reversing lever in one position, the handle can be used for tightening; in the opposite position, it can be used for loosening.

It is important to keep the ratchet handle clean and working freely. A few drops of oil should be applied to the mechanism from time to time. A well-built handle is designed to tighten any nut within its capacity, but it can be broken quite easily by using a piece of pipe to obtain greater leverage. Use of a hammer on such a wrench is out of the question, as the tool would be damaged beyond repair.

Accessories Available

In addition to the sockets and ratchet handle, a set of these tools may contain a variety of accessories to increase adaptability to a wide range of work. The hinged, offset handle is extremely convenient. To loosen a tight nut the handle can be swung at a right angle to the socket to provide maximum leverage. Then, after the nut is loosened, the handle can be turned into the vertical position to spin the nut off.

The sliding offset handle has a head which can be positioned at the end or at the center of the handle, and is useful for extra leverage or two-handed operation. Combined with an extension bar, the sliding offset handle makes up into a T-handle wrench for reaching nuts in hard-to-get-at places.

Speed handles, sometimes called speeders or spinners, resemble the familiar carpenter's brace and are convenient for many jobs on which a number of nuts are to be run on or off in a hurry. They are not to be used for pinching up or breaking loose tight nuts, but are great time savers when properly applied.

A universal joint is often furnished with socket-wrench sets and is invaluable for working on nuts where a straight wrench cannot be used. It is placed between the handle and the socket, with or without one or more extension bars, and permits the handle to be operated at any angle to the socket.

When bolt ends protrude an unusually long way from the top of the nut, or for such special jobs as removing sparkplugs in automobile work, regular sockets cannot be used. Special deep sockets are available for jobs of this kind, and usually are cross-drilled so a bar can be inserted to make a T-handle wrench.

ADJUSTABLE AND MISCELLANEOUS WRENCHES

ADJUSTABLE wrenches are shaped somewhat like open-end wrenches, but have one jaw adjustable. They are commonly made single ended, although double-ended ones are available. The ordinary monkey wrench is also adjustable, but the term "adjustable wrench" refers specifically to the open-end, adjustable-jaw type. The angle of the opening relative to the handle is 22½°, and sizes vary from 4 in. to 18 in. in length.

The adjustable wrench is not intended to take the place of the regular solid wrench for steady, hard service. When using an adjustable wrench, always place it on the nut so the pulling force is applied to the stationary jaw of the handle, and always tighten the adjusting knurl so the jaws fit snugly on the nut. Failure to do this will place an excessive load on the teeth of the knurl and jaw rack, and will shorten its life.

The old-fashioned monkey wrench is fast disappearing from industry, although it is still a favorite for rough maintenance work. In some models the adjustment is made by turning a knurled nut, in others the handle is turned.

Pipe Wrenches

For rotating round work only, never for square or hex nuts, a pipe wrench may be used. This somewhat resembles a monkey wrench, except that the movable jaw is pivoted to permit a gripping action. These tools must be used with discretion because the serrated jaws always make marks on the work, and sometimes bite in quite deeply. The jaws should be adjusted so the bite is taken at about the center, and the handle can be pulled in one direction only.

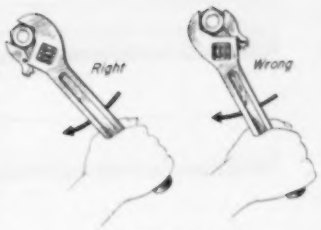
A different type, used chiefly on large sizes of pipe, is the chain pipe wrench. This tool works in one direction only, but can be backed partly around the work and a fresh hold taken in a sort of ratchet action without freeing the chain. To reverse its operation, the grip is taken on the opposite side of the head. The head is double ended and can be reversed when the teeth on one end are worn out. The strap wrench is similar, but uses a webbing strap instead of a chain, and has a smooth curved shoe, in place of the serrrated head.

Miscellaneous Wrenches

There are occasions when, for engineering reasons, a definite load must be applied to a nut. For this purpose a torque wrench must be used. This is most commonly used with a socket, and is made in several patterns. One model has a graduated scale for direct reading of the amount of force being applied, another has a dial on which the desired reading is set, and which is so designed that when this pressure is reached a light flashes or a buzzer sounds.

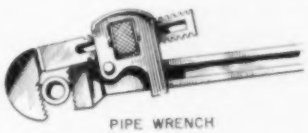
Socket-head screws require their own wrenches, supplied by the screw manufacturers. One type has a hex hole and uses an L-shaped bar of hex tool steel. Other types have holes of different shapes with matching wrenches. Keep the end of the wrench free from burrs, and resist the impulse to obtain added leverage by a piece of pipe slipped on the end, or by hammering.

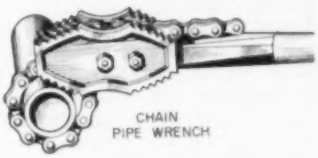
Sometimes special nuts are made with notches cut in their outer edge. For these a hook spanner is required. This has a curved arm with a lug which fits into one of the notches. It may be made for one particular size nut, or it may have a hinged arm to adapt it to a range of sizes. U-shaped hook spanners and end spanners are designed to fit into notches cut in either the face or the edge of round nuts. The former is U-shaped and has lugs on its face, while the latter resembles a socket wrench but has a series of lugs on the end. Pin spanners have a pin in place of a lug and the pin fits into a hole in the edge of the nut. Face-pin spanners are similar to U-shaped hook spanners except that they have pins instead of lugs.



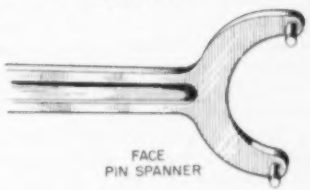
ADJUSTABLE WRENCH

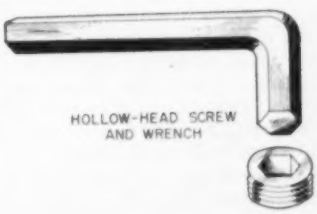
MONKEY WRENCH

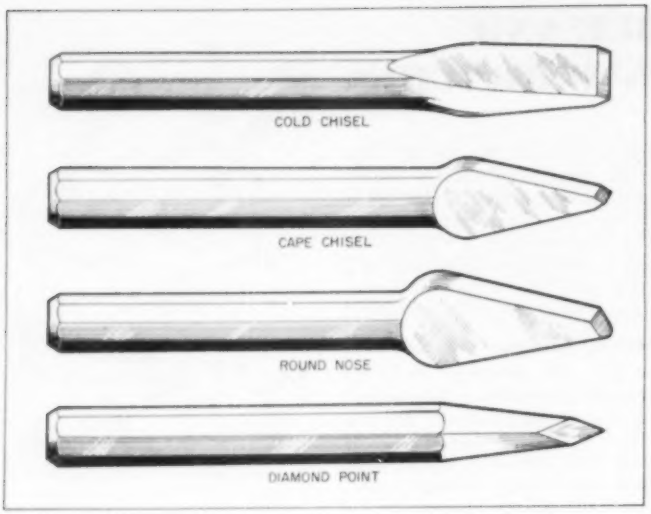

PIPE WRENCH


CHAIN PIPE WRENCH

HOOK SPANNER


FACE PIN SPANNER


HOLLOW-HEAD SCREW AND WRENCH



CHISELS

In the hands of a skillful mechanic a chisel can be made to do almost anything a milling machine can do, although perhaps less accurately and at the expense of greater time and energy. Chisels are made from tool steel by heating the end of a bar and hammering it into the desired shape. The bar is usually octagonal, but may be round, square, rectangular or hexagonal. After forging, the chisel must be hardened to give it the ability to cut metal, and tempered or drawn at the cutting edge to prevent chipping. The head end is usually chamfered to reduce the amount of mushrooming from repeated hammering, and to avoid a sharp edge.

The type most commonly used is the flat cold chisel, which serves to cut rivets, split nuts, chip castings and forgings, and cut thin metal sheets. Also used for special jobs are the cape chisel for cutting keyways, narrow grooves and square corners, the round-nose chisel for semi-circular grooves and for chipping inside corners with a fillet, and the diamond-point for cutting V-grooves and sharp corners.

A classical job for the round-nose or diamond-point chisel is the "moving over" of a drilled hole. When a conventional drill is started in a centerpunch mark, it may run to one side of the circumscribed circle. The chisel is then used to chip grooves on the opposite side to "pull the hole over."

As with other tools, there is a correct technique for using a chisel. To start with, use a chisel that is big enough for the job. The width of the cutting edge denotes the size, but it is sometimes necessary to use an extra-light or extra-heavy tool for special jobs. Also, be sure to use a hammer that matches the chisel—the larger the chisel, the heavier the hammer. A heavy chisel will absorb the blows of a light hammer like an anvil and will do virtually no cutting.

A chisel is usually held in the left hand with the thumb and first finger about 1 in. from the top. It should be held steadily but not tightly. The finger muscles should be relaxed, so if the hammer strikes the hand it will slide down the tool and lessen the effect of the blow. Keep the eyes on the cutting edge of the tool, not on the head, and swing the hammer in the same plane as the body of the chisel. If considerable work is being done, a piece of rubber hose may be slipped over the chisel to make an easier grip and lessen the shock.

In chipping, the depth of cut is controlled by the angle at which the chisel is held. Don't try to take too deep a cut at one time. For rough cuts, 1/16 in. is sufficient; for finishing, take 1/32 in. or less. Always wear goggles when chipping, and see that others in your neighborhood are also wearing them or are protected by a screen from the flying chips. Always chip away from yourself, and if the work is held in a vise, chip toward the stationary jaw.

For effective work, a chisel must be sharp. In sharpening, hold the edge against the wheel with only light pressure to avoid overheating, and dip the edge in water frequently enough to keep it cool. Try to maintain the original angle of the cutting edge by grinding only a small amount at a time from each side. For best results the edge should not be straight, but should be ground to a slight radius, higher at the center than at the ends.

If the temper has been drawn by overheating during grinding, or if the tool has been reground so often that the hardened section at the end has been all ground away and the tool will no longer hold an edge, it must be re-hardened. This job should be given to an experience heat treater or a good blacksmith, the latter if the entire front end requires reshaping to its original form. At every grinding, check the top end for ragged edges or mushrooming, and grind off smooth. Mushroomed heads are dangerous to the user and the bystander, as fragments may fly off and cause injury, and the ragged edges can inflict painful cuts if the chisel slips.

SCREWDRIVERS

Most frequently abused of all tools is the screwdriver. It has one function, and one only—to drive and remove screws. It is not to be used as a pry bar, a scraper, a cold chisel, a punch or a drift. There are times when a screwdriver may be used for gently levering two pieces apart, but it must be remembered that the shank is not designed to withstand severe bending, and the hardened blade may easily break.

For general purposes, screwdrivers are classified by size, according to the combined length of shank and blade. They run from about 2½ to 12 in. but there are many smaller and some larger for special purposes. The diameter of the shank, and the width and thickness of the blade are proportionate to the length, but again there are specials with long thin shanks, short thick shanks, and extra wide or extra narrow blades.

Handles may be of wood, plastic or metal, or may be of one piece with the shank, with or without wooden grips. In some types the shank extends all the way through the handle, in others the shank enters the handle only a short distance and is pinned in place. Plastic handles are usually molded around the end of the shank. There are also ratchet screwdrivers, offset screwdrivers for close-quarter work, and special self-gripping and self-centering screwdrivers. For the heaviest work, special types are made with square shanks designed to be gripped with a wrench, but this is the only kind on which a wrench should be used. Never use a wrench or pliers on ordinary screwdrivers.

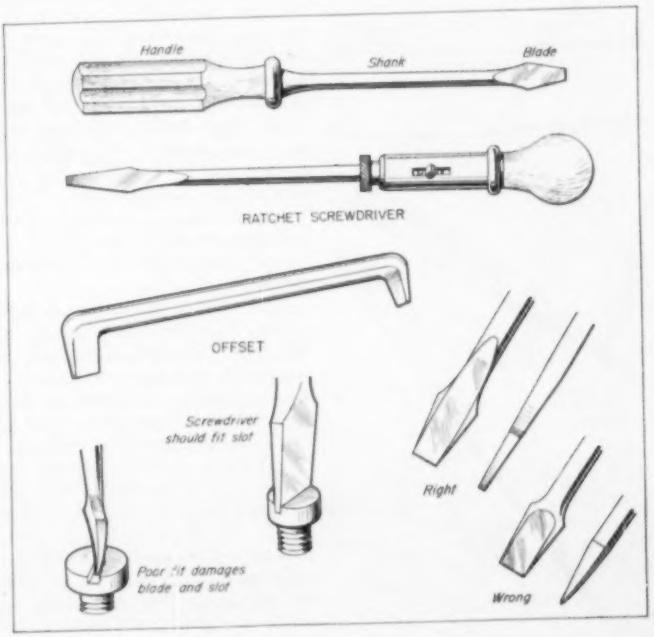
It is important to select the size of screwdriver so the thickness of the blade is a good fit in the screw slot. This prevents burring the slot and reduces the force required to hold the driver in the slot. The tip of a screwdriver should have the sides of the blade parallel or nearly parallel. Most, but not all, manufacturers reduce manufacturing costs by making the sides with a gradual taper, and this is usually satisfactory if the taper is not too steep. If it is too steep it will be impossible to keep the blade in the screw slot, and slots will be burred and adjacent surfaces marred by scratches when the driver slips. Always keep the blade squarely in line with the axis of the screw. If it is tipped it will either slip out of the slot or will burr it up so badly that it may be impossible to turn the screw.

A good idea is to regrind the sides of a screwdriver so they are parallel for a short distance, or slightly concave. This will insure the bit remaining in the screw slot even when a severe twisting force is applied. Another fault common to most screwdrivers is the excessive flare at the sides of the blade. This often prevents the blade from getting down into counterbores. So it is a good idea to grind the flare off, too. Take off a little at a time and keep dipping in water to avoid drawing the temper. Make sure the end is ground straight across, and never grind the faces so they form a sharp edge at the tip.

Recessed-head screws are now available under various trade names. These have a cavity of special shape formed in the head, and require a specially shaped screwdriver supplied by the manufacturer. They have the advantage of somewhat faster assembly and better appearance, and the driver cannot slip out of the slot and mar the finish.

For fast, easy work the ratchet screwdriver is extremely convenient as it can be used one-handed, and does not require the bit to be lifted out of the slot. It is fitted with either a standard type bit or special bit for recessed heads, and the same precautions should be taken as with a regular driver.

For close quarters the offset screwdriver is invaluable. It is usually made from round or hex steel stock and has the blades at opposite ends turned in opposite directions so it can operate in quarter turns. Miniature screwdrivers are available in many sizes and are useful for tiny setscrews, instruments and other small jobs.



PLIERS

SLIP JOINT

SIDE CUTTERS

NEEDLE NOSE

DIAGONAL CUTTERS

THERE is a definite field of usefulness for pliers, but it is emphatically not as a substitute for a wrench. There are dozens of patterns of pliers, each designed for specific purpose and each made in several sizes, but combination slip-joint pliers are among the most common. The slip joint permits the jaws to be opened wider at the hinge pin for gripping large diameters. They are to be used for holding round bar or pipe, and should never be used on nuts. Indeed, it is a good practice never to use pliers when any other tool will serve. Above all, they should never be used on hardened material, as this dulls the teeth and the pliers soon lose their grip. The flat part of the jaws may be used for holding or pulling sheet metal or wire, and some models are made with a side cutting arrangement for cutting wire.

Diagonal cutting pliers have the cutting jaws at an angle and are intended specifically for cutting wire. They are also useful for removing and installing cotter pins, cutting them to length and spreading the ends. Side cutters are convenient for cutting and bending wire, and frequently have insulated handles for protection in electrical work. Other types include round nose and needle nose for bending wire and forming springs; long nose, either duckbill or flat nose types; parallel-jaw pliers and parallel-jaw cutters for greater holding and cutting power, and others designed for special jobs or special industries.

PUNCHES

CENTER PUNCH

STARTING PUNCH

PIN PUNCH

AUTOMATIC CENTER PUNCH

ALIGNING PUNCH

ESSENTIAL in every machinist's toolkit is a center punch. As its name implies, it is used for marking the center of a hole to be drilled. When the drill point is placed in the center punch mark, it will start drilling at that particular point, but if there is no center punch mark it will wander all around on the work unless restrained by a fixed bushing. Another use is for making corresponding marks on two pieces to permit re-assembly in the original positions.

The point is accurately ground central with the shank, usually at 60°, and is difficult to regrind by hand with any degree of accuracy. It is, therefore, advisable to take care of a center punch and not to use it on extremely hard materials.

Automatic center punches are useful for layout work. They are operated by pressing down on the shank. An inside spring is compressed and released automatically, striking a smart blow on the end of the punch. The impression so made is light, but adequate for marking, and serves to locate the point of a regular punch when a deeper impression is required.

Starting punches, sometimes called drifts, are made with a long taper from the flat tip to the body to withstand heavy blows. They are used for knocking out rivets after the head has been cut off, and for driving out straight or taper pins. After the pin has been driven partly out of the hole, the starting punch can no longer be used because the increasing taper becomes too large for the hole. A pin punch must then be used. This is made with a straight shank—no taper—so it fits into the hole. Always use the largest starting and pin punches that will fit into the hole. Never use a pin punch to start a pin because, since it has a slim shank, a hard blow may cause it to bend or break.

For assembly work, an alignment punch, also called a drift, is invaluable. These are usually about 1 ft long and have a long, slow taper. Their purpose is to line up holes in mating parts.

TAPS AND DIES

Taps are used to cut internal threads, and are made in all standard diameters and pitches. The end of the shank is formed to a square for gripping in a tap wrench. Taps are frequently made in sets of three: a taper or starting tap for getting the thread started and removing the bulk of the metal, a plug tap for finishing the hole to size, and a bottoming tap for cutting to the bottom of blind holes. An experienced worker sometimes omits the taper tap and works with the plug tap only, but it is difficult to start such a tap straight.

Taps are hardened, and are easily broken if too much force is applied. There are two schools of thought regarding tapping; one holds that the tap should be screwed straight in, the other contends that the tap should be given about a one-quarter turn, backed away slightly, and then given another quarter turn. The latter method is usually preferred with small sizes which are so easily broken. Taps which break below the surface of the work are difficult to remove without special extractors.

Always use a proper tap wrench for tapping. A regular wrench will impose a bending action and will break the tap. Tap wrenches are made in two styles—the bar type and the T-handle. The bar type has two V-shaped jaws, one of which is free to slide and is tightened on the tap by screwing one handle. This type is preferred for all-around work. The T-handle type has a two-jaw chuck and is used chiefly for small taps and for tapping at an angle, as one hand can be used to turn the wrench and the other to guide the tap. A little oil applied to a tap or a die, particularly when cutting steel, will make the job much easier and will produce a smoother and better thread, and will prevent tearing.

External Threading

For cutting external threads, a die is used. The commonest type is the adjustable, round button die which is split through one side and may be adjusted for tight or loose threads. It is held in a diestock by three cone-pointed setscrews, one of which engages the split in the die and is used for expanding it, while the two others are used for retaining or compressing. Disadvantage of this system is that the die must be adjusted every time it is placed in the diestock. To overcome this, some dies are made with a setscrew in the split, and others are fitted with a solid collet which has an adjusting setscrew.

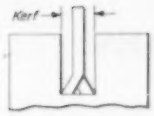
The diestock has an inside lip against which the die rests, and care must be taken to have this lip upward to take the thrust when tapping. Otherwise the die may be forced out of the diestock and the screws bent or broken. Care must also be taken to install the die the right way up in the stock. One end of the thread in the die is chamfered to permit easier starting on the work. The die may be reversed, however, for cutting the last two or three threads close to a shoulder.

Precision dies are available with removable chasers for accurate adjustment and easy resharpening. For lower accuracy, solid (non-adjustable) square dies may be used, and for recutting rusted or damaged threads, hexagon re-threading dies, or nut runners, are convenient. These latter may be turned with a standard wrench.

For larger sizes, about 1½ in. and over, the adjustable diestock is sometimes used. This has a pair of adjustable dies free to slide in or out from the center, and an interchangeable guide bushing to help start the thread straight. Handles are usually removable to save space when not in use. It is chiefly used for cutting pipe threads.

Now almost completely obsolete, although still found in some older shops, is the so-called jamb plate. This is a flat plate of tool steel with one or more dies formed in it by tapping a hole and then cutting away part of the thread to produce an effect similar to a button die.

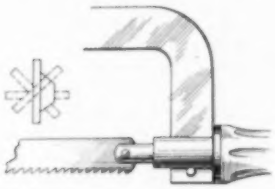
STRAIGHT GRIP



"Set" provides blade clearance

PISTOL GRIP

INVERTED GRIP



Variable blade positions

HACKSAWS

THERE are two parts to a hacksaw—the frame and the blade—and most frames are adjustable to take 8-, 10-, or 12-in. blades. Older styles have a straight handle in line with the blade, but newer types have a full pistol grip which is easier and less fatiguing to use. Some manufacturers now combine the convenience of a pistol grip with the advantage of the straight handle—where the applied force on the forward stroke is delivered in direct line with the blade—by making an inverted handle.

All adjustable frames are made so the blade can be used in either a vertical or a horizontal position, and on some types the blade can be positioned at four or six different angles. This is an advantage where the saw must be used in places where there would not be sufficient clearance for the conventional saw with only two blade positions.

To install a blade in a frame, adjust the frame for the length of the blade with sufficient adjustment remaining to permit the blade to be tightly stretched. Place the blade on the pins with the teeth pointing away from the handle, and screw up the adjusting nut until the blade is rigid.

In starting a cut, use the thumb of the left hand to guide the blade until the cut is started. Use sufficient pressure in starting the cut so the saw begins to bite into the metal immediately. The cutting action is similar to that of a file, and if the teeth do not bite into and cut the metal, the rubbing action will dull them. Relieve the pressure on the return stroke, but do not lift the blade off the work when the cut is being started. When the kerf (the slot made by the saw) is deep enough to guide the blade, the saw can be lifted slightly on the back stroke.

Use, as far as possible, the entire length of the blade on every stroke, except when starting, and keep the blade moving in a straight line to avoid any twisting or binding action. Try to keep at least three teeth in contact with the work at all times. If the work is thin, use a fine-tooth blade and, if necessary, tilt the saw up or down to increase the length of the kerf. For thin sheet stock, clamp the work between two pieces of wood and cut through the sandwich thus made.

Keep enough pressure on the blade to prevent it from being pinched or jammed, as this often breaks some of the teeth or breaks the blade. If a blade breaks and the operation must be finished with a new blade, always start a new cut with the new blade if possible. If the work is round, rotate it and start the new cut in line with the first one. If the work is flat, start the new cut from the other edge. This is because a new blade has more set than a worn one, and will usually jam in the narrow kerf already made.

The set in a saw refers to how much the teeth are pushed out in opposite directions from the sides of the blade. Set is necessary so the kerf will be slightly wider than the thickness of the blade and thus provide clearance to prevent sticking. Blades are made with 14, 18, 24, and 32 teeth per in. The 18-tooth blade is most commonly used for general work, and the 32-tooth for thin sheet and tubing.

Protect the teeth of a hacksaw from contact with hard materials when not in use, and wipe the blade with an oily rag after use.

FILES

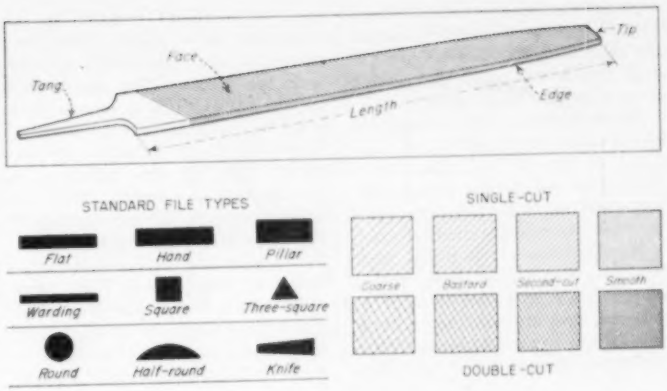
THERE are more than 20 different types of files in common use, and each type may range in length from 3 to 18 in. They are graded according to the degree of fineness, depending on the size and spacing of the teeth, and according to whether they are single- or double-cut.

The length of a file is the distance from the point to the heel, and does not include the tang. Single-cut files are those having a single row of parallel teeth set at an angle across the face. Double-cut files have a second row of teeth crossing the first. There are four standard grades: coarse, bastard, second-cut, and smooth.

Never use a file without a handle, and remember that a file is made to cut in one direction only—when it is being pushed forward. Raise the tool slightly on the back stroke. Keep files clean by use of a file card, and protect them from rust

and oil. A little chalk rubbed on the teeth will help to prevent loading and will get rid of oil. To keep them sharp, see that their surfaces are protected when not in use. Do not throw them around on the bench or into a drawer with other tools, and never use them for any purpose other than filing. Never, never hammer on a file, and never use it as a pry bar.

Full information on the care and use of files was published in an *American Machinist* Special Report "How to Choose and Use Files," May 5, 1949.



MISCELLANEOUS TOOLS

SCRAPERS are frequently made from old files by annealing, forging to shape, and rehardening. They are used for finishing smooth flat or curved surfaces. The decorative, mottled effect sometimes seen on lathe beds (called "frosting") is produced by hand scraping, but the process is now giving way to precision grinding, as hand scraping is slow and laborious and demands years of experience. Curved scrapers are still used for accurate fitting of soft metal bearings, as they permit the removal of minute amounts of metal from high spots. Three-cornered scrapers are useful for removing burrs.

Scribers are long, slender, sharply pointed tools used for scratching lines on metal for layout work. They are the metalworker's equivalent of the draftsman's pencil.

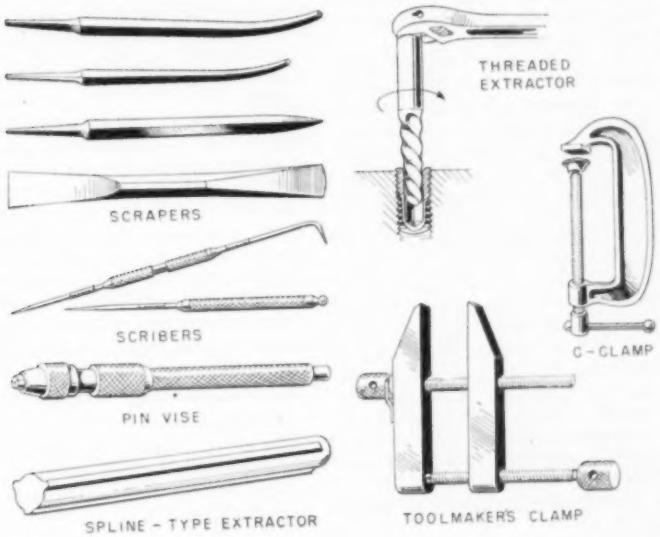
The pin vise is a small handle, having a chuck at one end, for holding pins and other tiny work.

C-clamps are temporary fasteners for holding two pieces of material together. An adjusting screw passes through one of the arms and has a swiveling shoe to prevent marking the work. Parallel clamps, also known as toolmaker's clamps, have two screws so the jaws always stay parallel to each other. They will hold work firmly and evenly, as they have a much larger gripping area than a C-clamp, and can grip with the extreme tip.

Increasingly popular are the self-locking clamps operated by a cam and lever, and the plier type. Sold under several trade names, they are particularly useful for sheet metal work.

For removing studs or screws which have broken below the surface of the work, several types of extractors are available. The commonest is in the shape of a coarse-pitch, tapered, left-hand screw, and comes in several sizes. The tool is hardened, and the edges of the thread are sharp. To use it, a hole is drilled down the center of the broken stud, and the extractor is inserted and turned in a left-hand direction. The sharp threads bite into the sides of the hole, and as the tool continues to turn it unscrews the stud and removes it. In using such an extractor, always select the largest size the particular stud will take, and drill the hole just a little smaller than the small diameter of the stud thread.

Another type of tapered extractor has four straight flutes with sharp edges. This is tapped into the drilled hole with a hammer to cause the sharp edges to bite into the walls of the stud, and then unscrewed with a wrench. A third type has three sharp splines with no taper, and is also driven in with a hammer. This type is furnished



with the correct size drill for each extractor, and with pilots to center the drill. For the tapered models, drill size is less important, and a certain leeway is permissible.

All extractors are hardened, and hence brittle, so considerable judgment is needed in using them. After the tool gets a bite on the screw, pressure should be applied gradually to prevent breaking it.

Hand reamers are fluted tools having a number of sharp cutting edges. They may be straight or tapered, and are used for enlarging drilled holes and producing a smooth finish, and for accurate sizing. Conventional practice is to drill the hole about 0.005 in. undersize and then finish to size with the reamer. The shank end of the reamer has a square and may be held in a tap wrench. When used for enlarging holes, rather than for fine finishing, a rose reamer is selected. This has cutting edges on the end and tapers slightly toward the shank.

Tin snips are employed for cutting thin sheet metal. They have short, heavy blades and long handles to give adequate leverage. For cutting curves, a special type is made with narrow, curved blades.

HAND REAMER

TIN SNIPS

TAKE CARE OF YOUR TOOLS

IT HAS been said "A poor workman blames his tools," and while it must be admitted that it is difficult to do good work with inferior tools, nevertheless, manual skill will frequently make up for tool deficiencies. As a matter of fact, no poor tools are made by reputable manufacturers; competition has seen to that. But even the best tool can quickly be ruined by careless and improper handling, where, properly used and properly cared for, it will give years of satisfactory service.

There is a right way to handle each tool, but there is no essential difference in the manner of taking care of them. If they are intended to have sharp edges, see that they are kept sharp. If sharp edges are not required, see that they do not develop as a result of wear. On chisels, punches and similar tools designed to be hammered, watch that the head end does not become burred or mushroomed. Dress and grind them carefully; too heavy or prolonged pressure on a grinding wheel will burn the edge and draw the temper.

Do not use a tool for any purpose other than that for which it was designed. A chisel, screwdriver, or wrench is not a substitute for a pry bar, a screwriver may not be used as a chisel, nor pliers take the place of a wrench, and a hammer is the only tool to be used for hammering. Failure to observe this rule will inevitably result in bent and broken tools.

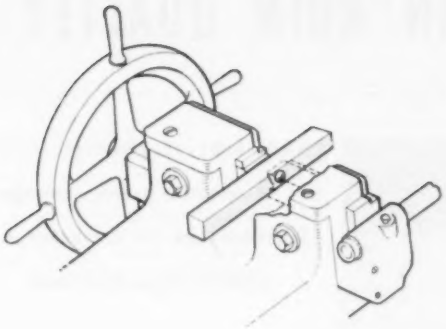
Never use a cracked or broken tool. It will always fail just when the pull is heaviest, and skinned knuckles may be the least of the injuries suffered. Keep wooden handles clean and free from splits or slivers, and make sure they are tightly attached to the tool. Never use a file without a handle.

At all costs, keep rust away. Rust is the greatest enemy of tools, but its prevention is simple. Every time a tool is put away, wipe it with an oily rag—that's all. Of course, it goes without saying that you will put your tools away, not leave them on the floor or tossed on the bench. Treat them with the respect good tools deserve; put them carefully in a box or drawer or, if circumstances permit, hang them up. Do not allow edged tools such as saws and files to knock against each other or against other tools, or the edge will soon be damaged. Files are the one exception to the oily rag rule. Keep them clean and dry but free of oil, or filing will be difficult if not impossible.

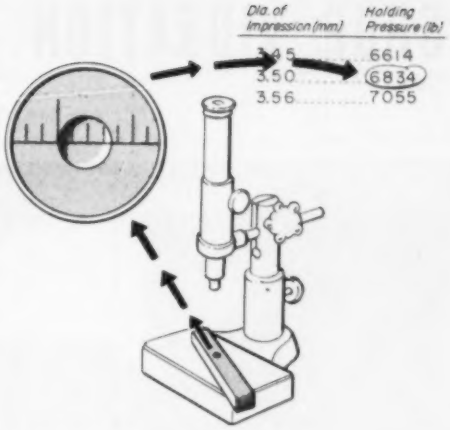
Always keep tools clean. Wipe them often to remove dust and grime, and occasionally give them a bath in kerosene or safety solvent. But don't forget to oil them lightly afterwards. An occasional drop of oil on the joint of pliers and the worm and rack of adjustable wrenches will make a world of difference to their ease of operation, and will prolong their life many times.

We acknowledge . . .

The generous assistance given in the preparation of this report by General Motors Corp. and Wright Aeronautical Corp.



Vise forces ball into test specimen and . . .



Diameter of impression fixes holding pressure

EASY TEST SHOWS SQUEEZE IN VISE

BY GEORGE E. HIEBER, Assistant Chief Engineer
LANDIS MACHINE CO., WAYNESBORO, PA.

A CONVENIENT, inexpensive method for measuring the holding pressure of a vise has been devised at Landis Machine Co. It is only necessary to close the vise on a test ball against a test specimen, measure the diameter of the impression, and read the holding pressure from a table of values that have been found accurate within 2%.

To obtain these data, several small bars of alloy steel were heat-treated to 300 Bhn (Brinell hardness). Then, a series of impressions were made with the standard 10-mm ball at 500, 1000, 1500, 2000, 2500, and 3000 kg. Observed pressures, with the exception of the 500- and 1000-kg readings, varied directly in proportion to the area of impression. Taking an average of several test pieces and calculating a series of figures for pressures and areas, the difference between calculated and observed areas was found to be less than 2%. Observed figures for one specimen are given. The 2% is remarkably low considering all the variables that can cause it.

With a heat-treated sample and a 10-mm test ball between the jaws of vise, it is an easy matter to squeeze an impression and get a figure for pressure from the table. Variations of this simple method are self evident, such as using two or more balls, or calibrating test specimens with larger-diameter balls and heavier loads.

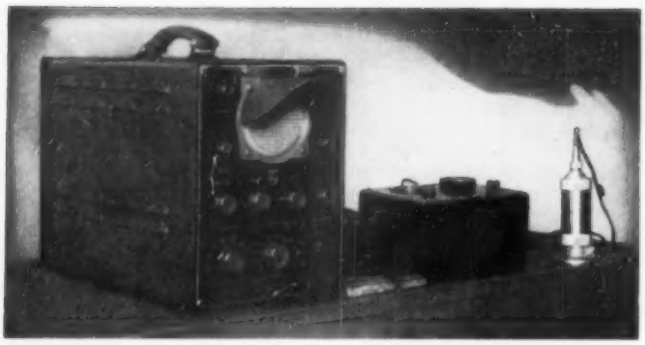
For some operations on our threading machines, a high torque resistance is required. Thus, this new method is particularly useful, as it permits a quick check of the holding power both of current vises and of new designs.

Holding Pressures Vary With Diameter of Test Impression

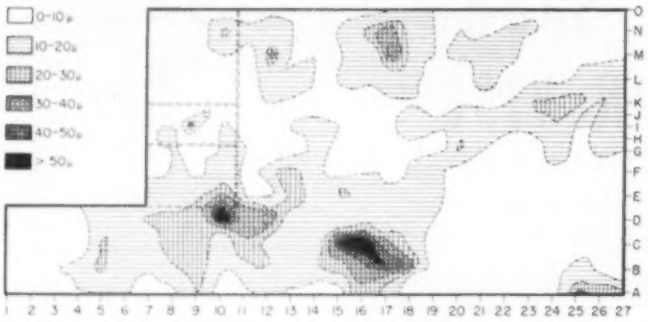
DIA. OF IMPRESSION (mm)		HOLDING PRESSURE (lb)
Calculated	Observed	
2.44	2.45	3306
2.52		3527
2.60		3747
2.67		3968
2.74		4189
2.81	2.82	4409
2.88		4630
2.95		4850
3.02		5070
3.08		5291
3.14	3.15	5511
3.21		5731
3.27		5952
3.33		6172
3.39		6393
3.45	3.42	6614
3.50		6834
3.56		7055
3.62		7275
3.67		7495
3.72		7716
3.77		7936
3.82		8157
3.87		8377
3.92		8598
3.97		8818
4.02		9039
4.07		9259
4.12		9480
4.17		9700
4.22		9920
4.27		10141
4.32		10361
4.37		10582
4.41		10802
4.45		11023

SHOP VIBRATION CAN RUIN QUALITY

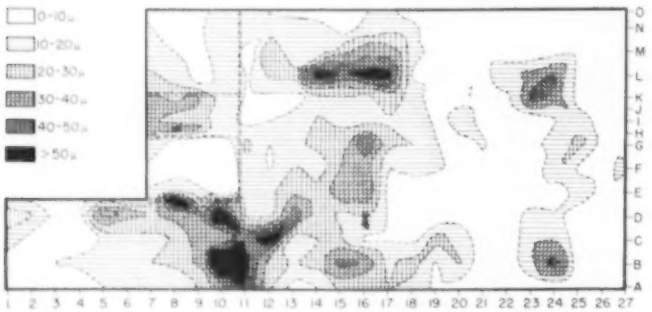
BY HANS BRANDERS, PRODUCTION MANAGER, KARHULA SHOPS, FINLAND



Vibration was measured with a Philips electronic-ray oscillograph GM3156, an electrodynamic vibration pickup GM5520, and a calibrator GM5522



Vibration from light work—Readings taken with even heavy machines operating on light work but no cranes or trucks involved. A vibration of 1 μ is about 40 microinches



Vibration from heavy work—Heavy pieces were being machined when these tests were made. Again all machines were operating, but no cranes or trucks affected the readings

With tests of vibration levels in a machine shop, machine locations can be corrected to improve the surface finish

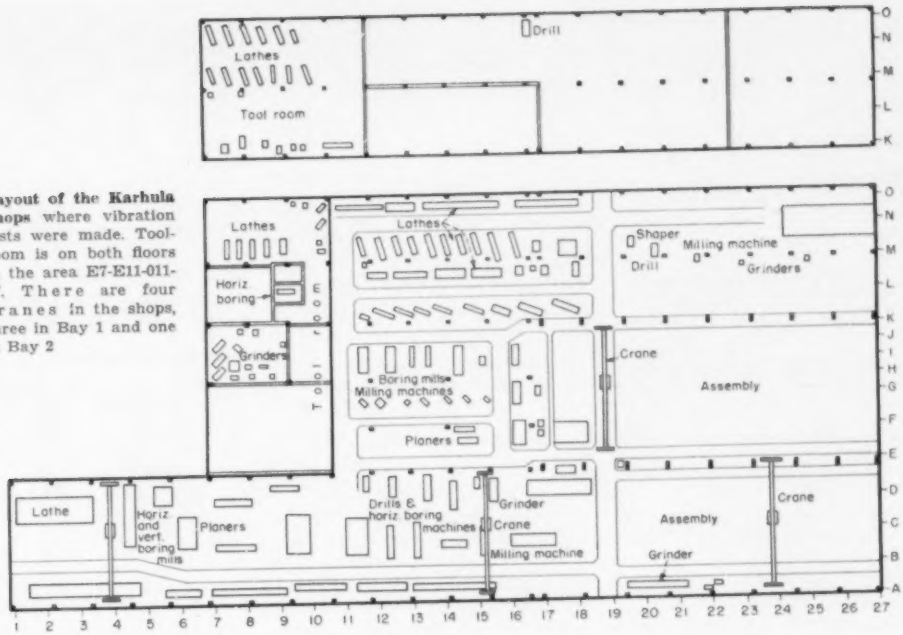
VIBRATIONS may have a detrimental effect upon the surface finish produced by machine tools. These vibrations may have their origin from a multitude of causes. They may originate from trucks moving on the floor of the shop, from overhead traveling cranes running along the craneways of the shop, from the machining of elements of irregular shape or from face-milling at high speed, to enumerate a few of the causes.

Each shop has its own characteristics of vibration, varying with the conditions prevalent at the moment, and depending to a noticeable degree upon the structure of the shop building, the quality or condition of flooring and machine-tool foundation, upon the kind of work performed in the machine shop, and other factors.

In order to establish the magnitude of the absolute value of vibrations prevailing in the machine shops where the author is production manager, some research work was carried out during the summer of 1948.

Measurement of the vibrations was made in the following way: The floor of the shops was divided into squares, with the help of crosslines spaced 5 yards from each other. Readings were taken at each intersection of the lines, and the vertical component of the vibrations was noted.

The products of the Karhula machine shops are machinery for paper, pulp, plywood, and steel mills. Thus it is a jobbing shop with work leaning towards the heavy side.



Layout of the Karhula Shops where vibration tests were made. Toolroom is on both floors in the area E7-E11-011-07. There are four cranes in the shops, three in Bay 1 and one in Bay 2

A general idea of the layout of the shops is shown in scale 1:800. The shops consist of three bays, of which the uppermost in the picture is built in two floors. Bay No. 1 is fitted out with three overhead traveling cranes of 15 tons capacity each, with a span of 58 ft, running the whole length of the bay—459 ft. Bay No. 2 has one 15-ton overhead traveling crane. The part of the shops, located to the left of the lane at vertical 19, is equipped with different kinds of machine tools.

Built on Bedrock

The shops were built between the years 1933 and 1944 on piles of reinforced concrete reaching to bedrock. Pile length varies between 16 and 50 ft. The shop structure itself is built of reinforced concrete. Flooring is supported on heavy main transverse and secondary concrete beams. The overhead traveling crane runways are made of steel I-beams, supported on the main concrete pillars.

The machine tools, with the exception of lathes at D-2 and A-3 which have foundations to bedrock, are erected on foundations cast of concrete around and upon the floorbeams.

Different causes of vibrations produce quite different amplitudes and frequencies at the primary spot where they originate. These amplitudes and frequencies add to each other in many different ways, either increasing or decreasing the resultant amplitudes or frequencies, at a given place.

It is thus very difficult to draw any definite conclusions from the results obtained from this research work, or to establish fixed laws for the behavior of vibrations. But some few general deductions may be drawn from the measurements, which can be of considerable value when a decision has to be made where to machine a workpiece demanding a particularly high standard of surface finish, or where to locate a machine which must be operated free from vibrations.

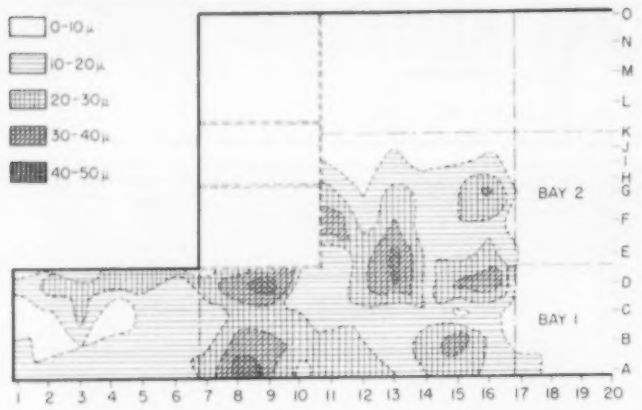
Light and Heavy Work

Two different readings were made at the Karhula machine shops. The first was taken on June 25, 1948, and at that time mainly light pieces of work were machined even in the heavier machine tools. At the second reading on August 15, 1948, heavy pieces of work were machined. At the time of both readings no measurement was taken when overhead traveling cranes or transport trucks passed the place of measurement. During the observations care was taken that all machines in the vicinity of the place of measurement were running, even if the machines not always were working under full load.

The vibrations were noted in μ which is about 40 microinches, and plotted into a chart or map, where all points with the same amplitude were interconnected. The resulting diagrams are shown with the code giving the values of vibrations in μ. The black areas are the spots where the amplitude of vibrations is higher than 50μ. The highest values encountered—70 μ—were at B 10-11 and E 8 when doing heavy work. The former value arose from turning a big eccentric piece of work in lathe at B-10.

The deductions which resulted from the analyzing of the maps and diagrams can be stated thus:

Lathes sometimes produce vibrations of noticeable magnitude, and



Vibration from Cranes—Tests were made on Sunday when the shop was not operating

vertical boring mills are more apt to produce vibrations than lathes of orthodox design.

Planers sometimes produce vibrations.

Milling machines produce vibrations, sometimes to a noticeable degree. Here a multitude of factors influence the magnitude of vibrations. The same can be said about horizontal boring machines, particularly when used for face milling.

Drilling machines of vertical type or radial type do not produce vibrations of noticeable magnitude.

Grinding machines also produce few vibrations, with the exception of double-wheel grinders used for rough grinding.

A common cause of vibration is *overhead traveling cranes*. In order to establish the magnitude of the vibrations thus produced, an investigation was made on a Sunday in August, when all other vibration producers in the shops were at rest. The results obtained during this investigation are plotted to show the maximum vibrations appearing at the points where readings were taken. Several different combinations of crane travel were arranged, and the results obtained were in many instances rather confusing. In Bay No. 1, all three cranes—of virtually the same size and design—were run either alone or all together. In many instances the maximum vibrations thus detected were quite independent of the number of cranes in action. Sometimes one crane caused vibrations of the same order as when all three were running. It also was noted that the vibrations produced by three cranes in action sometimes was less than vibrations produced by two cranes. This entitles us to make the assumption, that equalization of vibrations takes place, if the phases of vibrations for different cranes are running in opposite directions.

During the taking of measurements on August 15, the overhead traveling cranes and some platform trucks were run close to some of the spots of measurement. A noticeable increase in vibrations were thus noted in some cases, the maximum increase in original vibrations encountered being 100 μ in the case of a platform truck.

Flooring Important

The flooring of the shop is made of wooden blocks, and the fit of those blocks had a distinct effect upon the magnitude of vibrations when loaded trucks were passing. Loose blocks had a very detrimental effect upon the results.

The deductions made from the measurements described above have in some ways helped to correct the arrangement of machine tools and apparatus in the Karhula Shops, and thus contributed to improve the quality of its products. The interpretation of the results obtained and of the real character of the vibration manifestations is very difficult to make, and the research work done has only vaguely touched upon the many possibilities of research which here presents itself.

Any research done along the lines presented herewith has, to the author's knowledge, not been published before. It may, therefore, give impulses to research workers and shop men to further investigate the nature of vibrations and the wide scope this sphere of interesting science offers.

LEADSCREWS: TOOLS OR TRAPS?

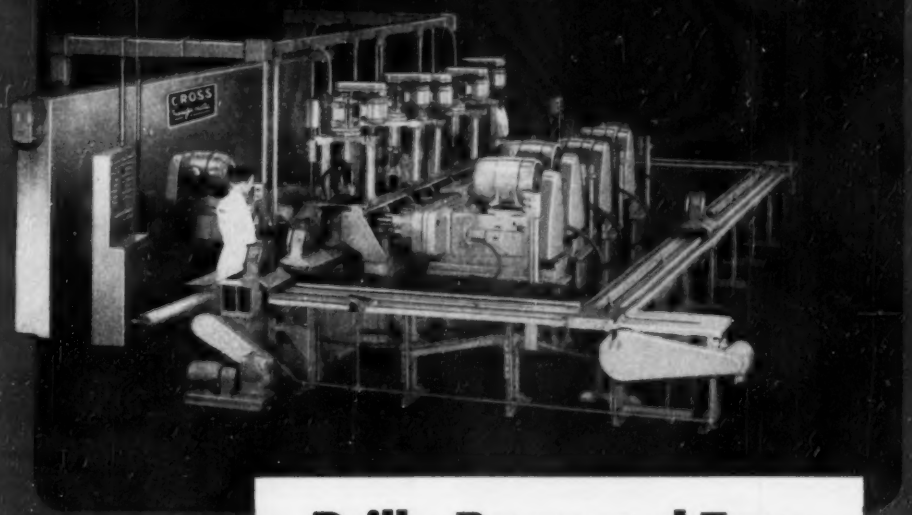
IT'S A DARN SHAME that the leadscrew of a lathe, upon which so much accuracy depends, should be exposed and neglected as much as it is. It is doused with oil periodically; left to collect dust, grit, and flies; and yet is expected to be in good shape when the split nut clamps the poor thing to its bosom.

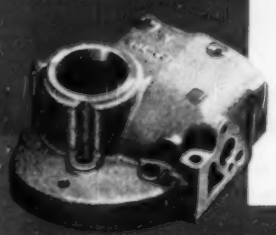
Inasmuch as only a small part of it is in engagement most of the time, why can't some wide-awake manufacturer design and build telescoping guards to protect it from unnecessary abuse?

Another important region such guards would protect would be the workers themselves. I have seen a number of near-calamities, where operators' aprons have been caught in the leadscrew and only pulled out in the nick of time. One little girl, who was visiting a shop with her mother, got her dress caught in a leadscrew. Her screams luckily brought a workman running in time to save her from actual danger, but not in time to save her a bad fright.

If all the unnecessarily exposed portions of leadscrews were laid end to end, a lathe operator could tread their helical paths a good piece down the road toward far-distant fishing streams. *Jack Everett, San Francisco, Calif.*

Another Transfer-matic by Cross





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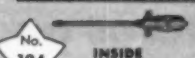

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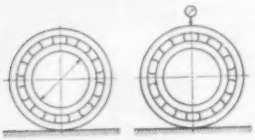
American Machinist

REFERENCE BOOK SHEET

Gaging of Ball and Roller Bearings

AN AMERICAN STANDARD PUBLISHED BY THE AMERICAN STANDARDS ASSOCIATION, NEW YORK

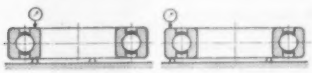
Users of precision anti-friction bearings may require an inspection method to determine whether purchased parts conform to required dimensional standards. These standard gaging practices were established as referee methods.



DIAMETERS

Inner Ring. Use two-point measuring device to determine the bore diameter d_m, which is the arithmetical average of maximum and minimum readings.

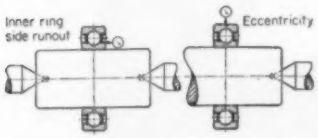
Outer Ring. Measure between a flat surface and a rounded indicating point to obtain D_m, which is the arithmetical average of minimum and maximum readings.



WIDTH AND PARALLELISM OF SIDES

Inner Ring. Support inner ring on three buttons. Rotate ring and take indicator readings. Lack of parallelism is the difference between maximum and minimum widths.

Outer Ring. Support outer ring on three buttons, and rotate ring while taking measurements.



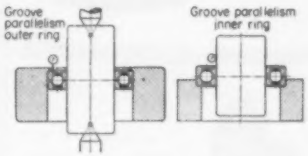
ECCENTRICITY AND SIDE RUNOUT

Mount bearing on arbor tapered 0.0001 to 0.0002 in. per in.

Inner Ring. Rotate arbor one revolution. Eccentricity is the difference between maximum and minimum readings.

Outer Ring. Repeat readings, but rotate the outer ring.

Side Runout. Shift indicator to side of inner ring; rotate arbor one revolution. Side runout is the difference between max. and min. readings.



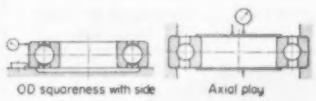
GROOVE PARALLELISM WITH SIDE (Groove-type ball bearings only)

Inner Ring. Support outer ring. Apply tapered arbor to inner ring, or use a true running weight that seals balls between raceways to give repetitive readings. Rotate the inner ring one revolution. Groove parallelism is the difference between maximum and minimum indicator readings.

Outer Ring. Mount inner ring on stationary arbor, apply true running weight to outer ring. Groove parallelism with side is the difference between maximum and minimum readings when rotating the outer ring one revolution.

OD SQUARENESS WITH SIDE

Support outer ring on flat plate with inner ring free. Position stop near lower corner of OD. Apply indicator directly above and near upper corner. The OD squareness with side is difference between maximum and minimum readings when the outer ring is rotated one revolution.

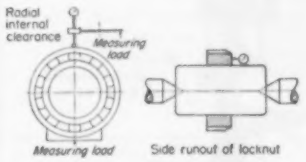


AXIAL PLAY

Lubricate bearing and clamp one ring to prevent axial movement. Apply specified reversing gaging load to unclamped ring so that resultant movement is parallel to bearing axis. The axial play is the total movement of the unclamped ring.

INTERNAL FIT

To find radial internal clearance of single-row ball or roller bearing, lubricate bearing with light oil. Support with axis horizontal so one ring cannot move (inner ring shown). Radial internal clearance is the total movement of the unsupported ring diametrically when the specified load is reversed, and readings averaged at different angular positions of inner or outer ring and balls, and with sufficient travel between readings to provide full rotation of the set of balls.



SIDE RUNOUT OF LOCKNUTS

Mount locknut on tight-fitting threaded arbor. Apply indicator to chamfer side of locknut. Side runout is the difference between maximum and minimum readings when rotating the arbor one revolution. Any part of the surface must be within tolerance:

FOR BALL AND ROLLER BEARINGS (EXCEPT TAPERED ROLLER BEARINGS).

N00—N06, inclusive	0.002 in. max.
N07—AN22, "	0.004 in. max.
AN24—AN64 "	0.006 in. max.

BORE AND OUTSIDE DIAMETER GAGING LOADS

Nominal Diameter			Gage Load	Gage Point Radius	
	Min		Oz	Min	In.
Inner Ring	Over	Incl			
	0	9	7 max.	0.8	0.032
Bore	9	30	7 max.	2.5	0.098
	30 and up		12	2.5	0.098
Outer Ring					
OD	0 and up		7 max.	2.5	0.098

RADIAL INTERNAL CLEARANCE GAGING LOADS

Loads		For Bearings with Bore
Kg	Lb	Min
2½ or 5½		0 to 18
5	or 11	over 18 to 50
15	or 33	over 50 to 140

AXIAL PLAY GAGING LOADS

Loads		Bearings with OD
Kg	Lb	Min
2½ or 5½		0 to 50
5	or 11	over 50 to 120
10	or 22	over 120 to 200
20	or 44	over 200

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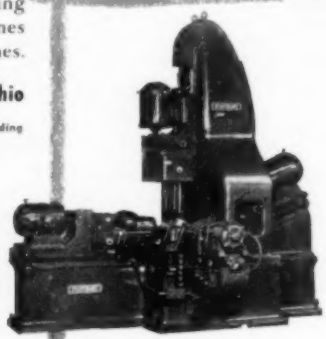

★ Five Way 21 Spindle Lead Screw Tapping Machine

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Methods of Measuring Case Depth...I

A recommendeed practice that will appear in the 1950 edition of the SAE Handbook published by the Society of Automotive Engineers, 29 West 39th St., New York 18, N. Y.

DEFINITIONS FOR CARBURIZED CASES

Effective case depth is defined as that distance measured perpendicularly from the surface of a hardened case to a point of hardness equivalent to Rockwell C 50.

Total case depth is defined as the distance measured perpendicularly from the surface of the case down through carbon enrichment.

The hardness traverse method is considered most accurate for effective case-depth measurement:

1. Cut specimen perpendicular to carburized surface from part to be examined.

2. Grind and polish specimen. Surface finish of the area to be traversed should be polished finely enough so as not to affect the hardness impressions; i.e., the lighter the indentor load, the finer the polish necessary.

3. Read to a point of hardness equivalent to Rockwell C 50. A plot of the hardness versus the depth from the surface will facilitate this reading. See sketches.

Hardness testers which use light indentor loads (examples—Tukon, micro hardness testers, Eberbach Vickers) are recommended for all procedures. Testers using heavier loads (examples—Rockwell Superficial, Rockwell A or Rockwell C) may be used for medium- and heavy-case measurements.

CARBURIZING GRADES OF STEEL

I. Microscopic Methods—Hardened Material

Carbon and Alloy Steels

1. Fracture or cut specimen.
2. Give full miscroscopic polish.
3. Etch in 3 to 5% Nital.
4. Read to 50% martensite at X100.

II. Microscopic Method — Annealed Material

Plain Carbon Steel

1. Fracture or cut specimen.
2. Protect by coating of copper or other material preventing loss of carbon.
3. Pack in charcoal. Place container in furnace at 1650-1700 F long enough for specimen to reach furnace temperature.
4. Remove from furnace and cool in retarding medium to 800 F in 2½ to 3 hr. Cool as desired from 800 F.
5. Polish specimen.
6. Etch in 3% Nital. Examine at 100 diameters.
7. For approximate effective case depth measurement, read down to 50% pearlite-ferrite combination point.
8. For total case-depth measurement, read the depth of carbon enrichment.

Alloy Steels

1. Fracture or cut specimen, protect by coating, pack in charcoal and place in furnace operating at 75-150 F above the upper critical temperature (AC_r-pt) for the core (generally 1600-1675 F).
2. Remove container from furnace and transform isothermally or cool at a sufficiently slow rate to insure maximum ferrite separation to 0.50 carbon level. If martensite is retained, to increase case contrast, temper specimen at 1000-1100 F and cool.
3. Polish specimen.
4. Etch in 3 to 5% Nital; examine at 100 diameters.
5. For approximate effective case-depth measurement, read down to 50% pearlite-ferrite combination point.
6. For total case-depth measurement, read the depth of carbon enrichment.

III. Brinell Glass Method

This method is recommended for routine production control or for laboratory use when properly correlated with more precise methods for both plain carbon or alloy steels in the hardened condition.

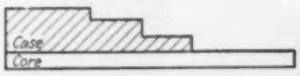
1. Prepare specimen.
2. Follow either of these methods:

(a) Rough-grind specimen and etch for 10 sec in a solution containing 50 cc of concentrated nitric acid, 5 gm of ammonium persulphate and 50 cc of water. Swab, rinse and dry prior to re-etching in 10% Nital. Examine with a Brinell microscope. Read all of the blue (darkened zone) for total case.

(b) Grind and/or polish on No. 000 metallographic emery paper or finer. Etch specimen in fresh 5% solution of nitric acid in ethyl alcohol at 70-80 F for 1 min., agitating continuously. Then rinse in two clean ethyl alcohol rinses. For total case-depth measurement, read all of the darkened zone. For approximate effective case-depth measurement, read from the ex-

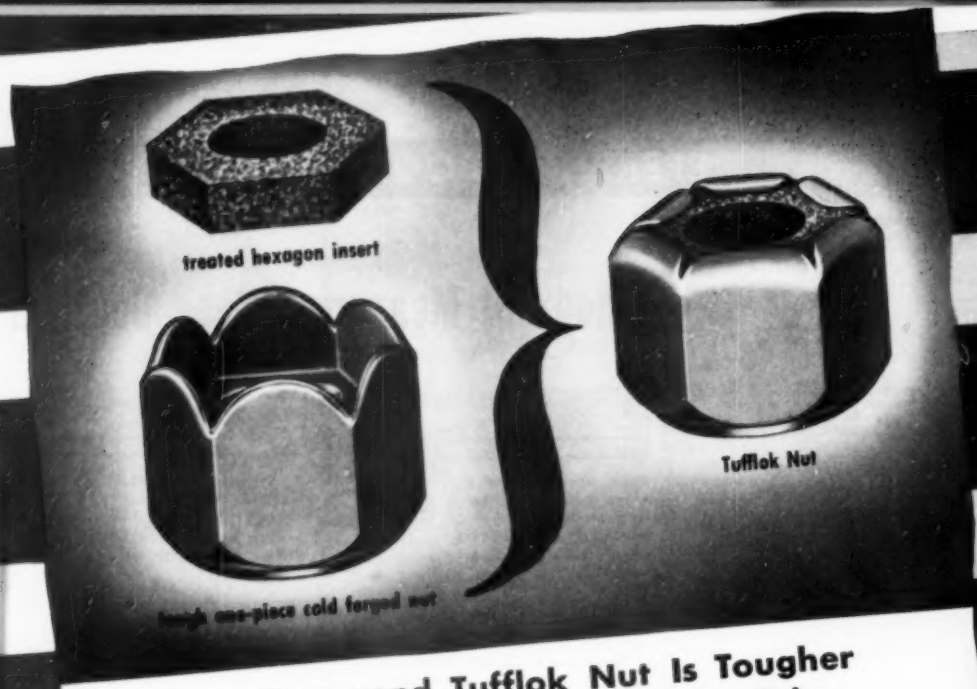
Taper sectioning of specimen provides more accurate readings on light and medium cases. Angle is selected so readings at spaced distances represent desired depth increments

For heavy cases, this alternate method of traversing the specimen may be used. But in either case, start hardness readings sufficiently below surface to provide indentor support



A step-ground section is recommended for medium and heavy cases. Hardness readings are taken on the steps, which are at known distances from the surface

Traverse procedure for reading hardness at various depths on light, medium and heavy cases, the specimen not being taper ground. Measure distance from surface to center of each indentation with a microscope



New Townsend Tufflok Nut Is Tougher Three Ways To Give You Tighter Grip, Greater Safety, With Economy

You get a tighter grip, greater safety and economy with the new Townsend Tufflok nut. It gives you more service at less cost. The exclusive Tufflok design*, plus the materials in the insert and nut body combine to give you the toughest lock nut yet produced for any use where nuts must stay put under a variety of adverse conditions.

Here are the New Exclusive Features of the Townsend Tufflok Nut:

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Methods of Measuring Case Depth...II

ternal surface to the center of the inner dark band.

IV. Fracture Method

This procedure is recommended chiefly as a production control method of measuring case depth of carburizing grades of steel.

1. Notch specimen and fracture.
2. Etch in 3 to 5% Nital and/or blue surface at 600 F.
3. Read with a Brinell glass to a depth previously correlated with more precise methods.

V. Step-Grind Method

This is recommended as a production control method of measuring effective case depth of carburizing grades of steel.

1. Use steel specimen measuring ½x⅝x2 in. long with known core hardness of Rockwell C 30-35 after oil quenching.
2. Load test bars at intervals with parts to be carburized.
3. Place hardened test bar in vise on surface grinder and grind two flats of required depth for case desired. A ½x7-in. grinding wheel of grade 58A-80-H-14-V-55 is recommended. Use surface grinds of 0.0005 in. depth per travel of the work table.
4. Check Rockwell C hardness of ground flats. The first ground flat should check Rockwell C 57-58 min., while the second should check Rockwell C 50 max.
5. Empirical guide for depth of grinds on test bars for required effective case:

Required Effective Case, In.	Amount Ground Off 1st Grind C-57 Min, In.	2nd Grind C-50 Max, In.
0.015 ±0.005	0.000	0.015
0.020 ±0.005	0.005	0.020
0.025 ±0.005	0.010	0.025
0.030 ±0.005	0.015	0.030
0.040 ±0.005	0.025	0.040
0.060 ±0.005	0.045	0.060

Note: In all cases the surface hardness of the hardened test bar is taken to serve as a guide on the type of case being produced. In other words, if the case is too rich or the surface carbon is depleted, then hardness will be several Rockwell C points below the hardness taken at a depth below the surface.

CYANIDED GRADES OF STEEL

1. Fracture or cut specimen.
2. Provide full microscopic polish.
3. Etch in 3 to 5% Nital.
4. The usual cyanide case contains a light etching layer followed by a total martensitic constituent, which in turn is followed by martensite with increasing networks of other constituents, depending on the type of steel which has been cyanided. The total case is easily read when steels of low carbon content have been used, and when the quenching temperature has been such that considerable ferrite is left in the region immediately below the case. These cases may be read to the bottom of the solid constituents and to the end of the fingers which extend into the core material.

When the material cyanided is such that total martensite occurs immediately below the case, greater difficulty is encountered. At times a fairly sharp line of demarcation can be noticed. When such is not present, the use of hardness tests shown under measurement of nitride case depth is recommended.

Note: Carbo-nitride refers to the hydrocarbon ammonia gas processes sometimes called dry cyaniding or gas cyaniding.

The process produces a case quite similar to that produced by cyaniding. The outer white layer may not be as pronounced and there may be considerable austenitic structure. These cases are read as described above.

NITRIDED GRADES OF STEEL

I. **The hardness traverse method** is recommended as the most accurate for the measurement of a nitrided case.

II. Microscopic Method

1. Fracture or cut specimen.
2. Provide full microscopic polish.
3. Etch with 4% Picrol—10 parts; 4% Nital—1 part.
4. It is more difficult to read nitride case depth microscopically than it is to read carbide case depth, since the gradual diminution of nitride network constituent makes it almost impossible to determine exactly where the case ends. This reagent delineates the high-nitrogen layers on the surface and the iron nitride network constituent within the case.

III. Fracture Method

This method is very rough and is recommended only where the crudest type of measurement is desired.

FLAME AND INDUCTION HARDENED STEEL

I. Microscopic Method

1. Cut specimen.
2. Provide microscopic polish.
3. Etch in 5% nitric acid in denatured alcohol for 4 min. Agitate while etching.
4. Measure depth of fully martensitic structure. This is considered the fully hardened case depth. Continue microscopic exploration until the base metal structure is reached. The distance between the full martensitic area and the base metal is referred to as the transition zone.

II. Macroscopic Method

1. Cut sample at right angles.
2. Grind sample to a finish equivalent to No. 000 metallographic emery paper.
3. Etch in solution No. 1 composed of 5% concentrated nitric acid in denatured alcohol for 4 min. Agitate while etching. Transfer to Solution No. 2 composed of 10% concentrated hydrochloric acid in denatured alcohol for 8 min. Agitate while etching. Transfer to Solution No. 3 composed of 15% ammonium hydroxide in denatured alcohol for 4 min. Agitate while in solution.
4. Rinse and dry.
5. Measure depth with a Brinell glass down to the line of demarcation between hardened surface and core.

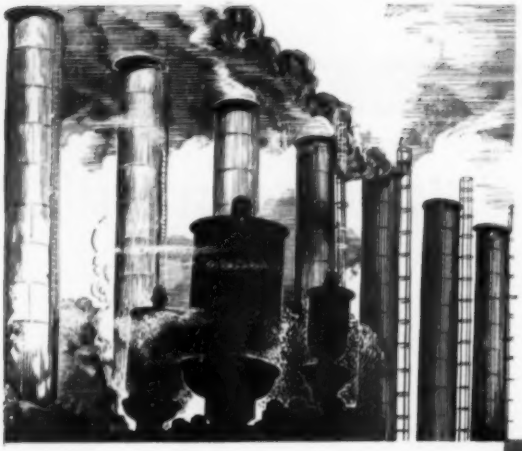
III. Macroscopic Method

(When saw cutting is necessary)

1. Temper part at 950 F.
2. Saw section to be examined.
3. Grind to a finish equivalent to No. O metallographic paper.
4. Etch in ammonium persulphate.
5. Rinse in water—swab to remove smudge.
6. Rinse in hot water and dry.
7. Measure depth with a Brinell glass down to the line of demarcation between hardened surface and core.

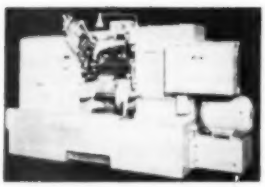
IV. Hardness Traverse Method

A hardness traverse check such as recommended for deep carburized cases may be used.

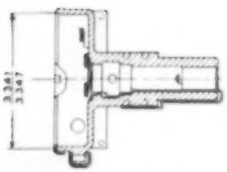


THERE'S plenty of business in sight for the manufacturer who can keep quality up and prices down.

That's no small order! Unless you are willing to gamble on lower *wages*, lower *taxes*, lower *material cost*, and lower *selling expense*, the only answer lies in more efficient production. That calls for *genuinely* modern production equipment.



NEW BRITAIN MODEL 61
AUTOMATIC CHUCKING MACHINE



This piece is turned out on two New Britain six spindle automatics equipped with magazine and work inserters which load the die cast aluminum pieces.

The first machine performs nine operations and turns out 736.7 pieces an hour. The use of a shave tool maintains very close tolerance on the outside diameters of the stem, with concentricity held within two thousandths.

The second machine matches the production of the first almost exactly, performing thirteen operations and delivering 735.1 finished pieces hourly. On this machine also extreme accuracy is maintained in finish reaming operations on both inside diameters.

NB

NEW BRITAIN

Automatics

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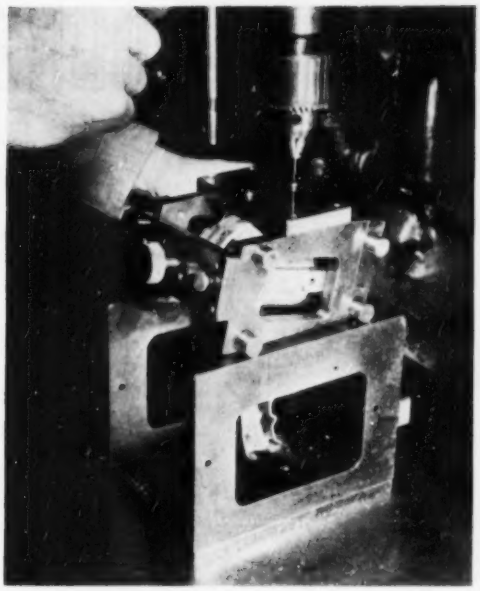
MULTIPLE SPINDLE AUTOMATIC SCREW AND CHUCKING MACHINES • SINGLE AND DOUBLE END PRECISION STRAIGHT AND CONTOUR BORING MACHINES • LUCAS PRECISION HORIZONTAL BORING, DRILLING AND MILLING MACHINES

Lightweight jig clamps on hand-tool housing with one thumbscrew. Nameplate holes are drilled with jig resting on rails, braced by operator's hand



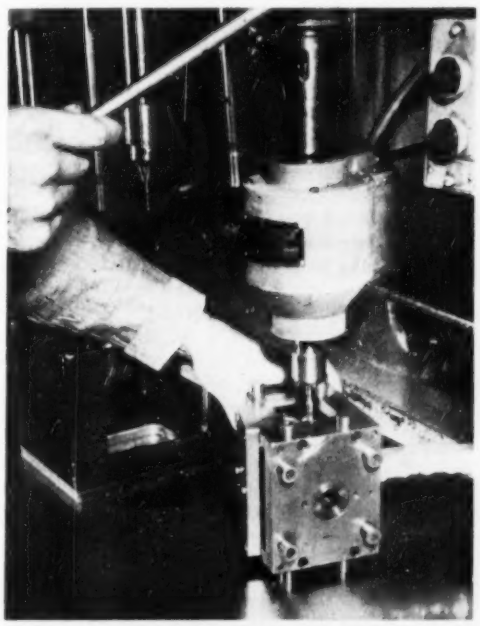
Housing handle, outside jig frame, clears table because rails are built up high enough. Four corner buttons on each side allow leveling the jig

Buttons and Bars Support Small Jig

BY J. J. TOPOLINSKI, Vice President, SKILSAW, INC.

WHEN engineers drew up drill jigs for Skiltool sander-polishers, they ran into the problem of what to do with the tool handle, which was to be die-cast in one piece with the motor housing. Instead of designing a large, heavy jig that would enclose the handle, they called for a small jig which would leave the handle out in the open. When drilling is done, the jig is held on a U-shaped rail frame that contacts ground buttons on the exterior of the jig.

Three sets of four each of the hardened and ground buttons are attached to three sides of the jig with shoulder screws. These can rest (on their ends) directly on the drillpress table, or can rest (on their circumferences) on the hardened and flat-ground top rails of the jig support. Cross plates on two sides of the jig carry guide bushings for drills.



Hardened buttons are ground to equal height, so cored holes in housing can be tapped in perfect alignment when jig is down on table

ROUND TABLE

Shot in the Arm

"Say, Ed, what have you done to the boys this morning — given 'em a shot in the arm?"

"If you noticed it, Al, it must work. It's just an idea my wife gave me last night."

"Now don't tell me your Better Half is getting interested in how you do your job! Isn't the pay check enough?"

"She wasn't talking about the plant at all. She just lit into me for not getting the lawn mowed or the screens painted and up, or the garden dug up. Told me I was getting lazier every year. Set me to thinking — and first thing you know I was mixing paint! She pushed me into getting started."

"Gave you a pep talk, eh, Ed?"

"Something like that! I figure that if it works on me, it would work on the boys too."

"Why should it? There's hardly the same feeling — they're working for pay, not to keep their own property up."

"But this business is their property, too, in a sense. Maybe it sounds hammy, but unless we all plug together, we all suffer. I figure if the wife can ding at me, I can ding at the boys."

"So, Ed, because you don't paint the screens, you figure the boys can take some of your lip . . . You're just taking it out on them."

"No, I'm not. I'm just trying to keep 'em on their toes, so we all do a better job. An occasional jolt helps anybody."

"Like fun it does! By tonight, most of 'em will be so mad at you they can't see straight. You can't bawl a man out for no cause except to give him a jolt."

"Oh, I found cause enough, don't worry. I panned Harrison for telling jokes instead of working, Madsen for having a dirty bench, Hayes for ruining a blueprint, and so on. I had plenty of reasons for riding each guy."

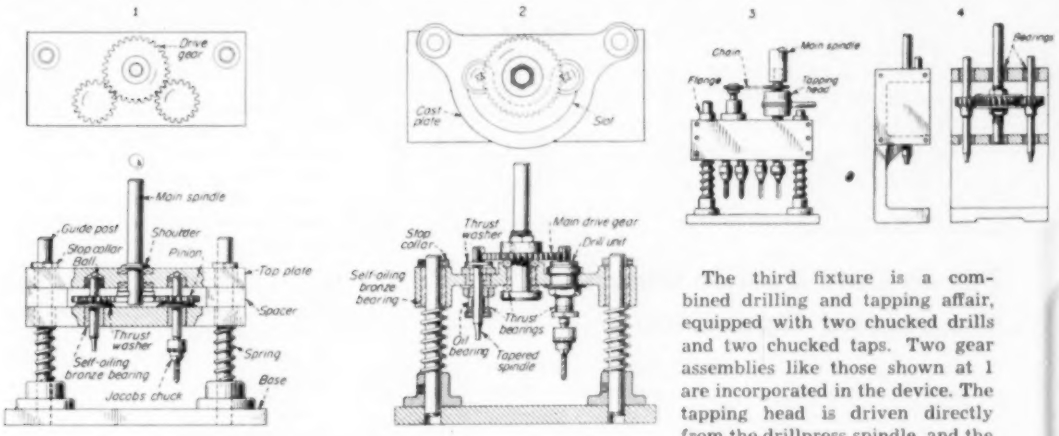
"Yeah, nice trumped-up ones! Don't think they won't realize it too! You may think you're giving 'em the needle, but all you're doing is making future trouble for yourself."

"We'll see, Al! After all, my wife's been at it for years, and I'm still taking it. And remember the old-style foreman used to do pretty well with an occasional shot in the arm."

"Yeah, Ed, but who needles your wife?"

IS THE "NEEDLING ROUTINE" *a good one for keeping men on their toes? Does it cause more trouble than it does good? Your ideas will interest others. Discussions of earlier topics appear on later pages.*

Practical Ideas



Four Multiple-Spindle Rigs Increase Drillpress Output

MULTIPLE - SPINDLE ATTACHMENTS for drillpresses are not new by any means, but these designs may suggest some new applications of the idea. All work from a single spindle and provide multiple spindles for increasing production.

The first attachment is for jobs where a fixed centerdistance between two holes is required, or where two drilling jobs are to be done in different parts. The fixture is built up from a baseplate and two flanges which locate guide posts. Two bearing plates are spaced apart by collars or blocks. These carry sleeve bearings which slide on the guide posts between compression springs and stop collars near the tops of the posts. Independent spindles carried between the two plates are tapered for small Jacobs chucks. The spindles are fitted with sleeve bearings, thrust washers, thrust bearing balls at their tip ends, and are keyed to gears which mesh with a gear on the main shaft. The main shaft is keyed to the large gear by means of two setscrews, and is fitted with thrust and radial ball bearings in the top plate. A shoulder on this shaft holds its position. Drive from the drillpress is through a chuck on the machine spindle. All sleeve bearings are bronze, self-oiling types.

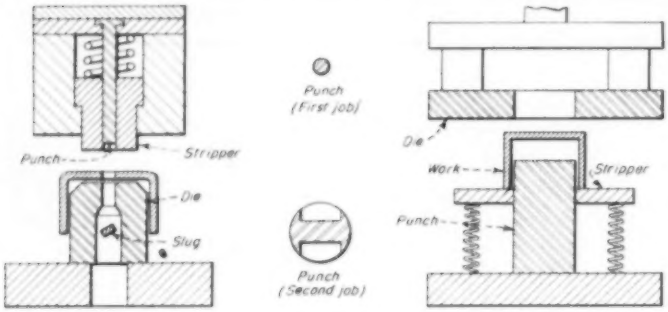
The second attachment is similar to the first, but allows adjustment of the centerdistance between the two spindles. A similar arrangement of guide posts, bearing plate, and springs allows vertical motion of both auxiliary spindles and the gearing assembly. The chuck-driven main shaft is held in the bearing plate by two ball-bearing rings and a sleeve bearing, and it is keyed to a large gear. However, in this fixture the working drill spindles are drill units made up of small pinions integral with the spindles, thrust-bearing assemblies, and small chucks. A circular slot in the bearing plate allows shifting the units around the large gear. The units are locked in position by tightening up on large nuts under the plate. These act against thrust washers. The spindles on both units are confined by ball bearings and retainer rings under the nuts.

The third fixture is a combined drilling and tapping affair, equipped with two chucked drills and two chucked taps. Two gear assemblies like those shown at 1 are incorporated in the device. The tapping head is driven directly from the drillpress spindle, and the drilling spindle is operated from a chain-sprocket takeoff directly above the tapping head.

The fourth fixture is a simple, easily-constructed two-spindle drill built up on an angle plate. Two bearing plates are fitted with sleeve bearings to allow free movement of the two spindles and the chucked drive shaft. Gearing is confined by two round plates that are clamped above and below the large gear. A threaded section on the shaft allows holding the main gear to the shaft by pressure between the nuts. Small gears can be held to the spindles by setscrews.

All fixtures should be guarded to prevent accidents, and also to keep lubricating oil from spraying all over the shop. For accurate drilling, any jigs positioned under the spindles should be fitted with guide bushings. In all cases illustrated, vertical motion of the working spindles is controlled by the feed lever of the drillpress.

It may be advisable to completely inclose all gear assemblies with sheet-metal plates and to pack the boxes with grease. Many variations of these drilling fixtures can be built up in the shop, depending on what use they are to be put. *Joseph F. Budnick, Bellerose, N. Y.*



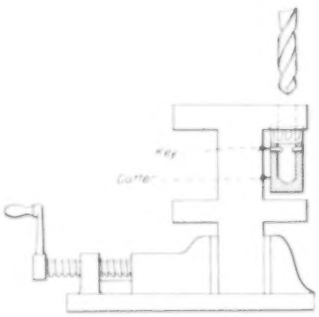
Punch Cuts Upside Down On Second Operation

SECOND OPERATIONS on punch presses are notoriously slow because of the time wasted in locating and ejecting the partially formed work. The nest or receptacle which holds the part must locate it accurately so holes can be punched in the right place, and must also allow removal of the part without too much trouble. Here are two examples of how second-operation locating has been done cheaply and quickly, allowing accurate work and speedy location and ejection.

Round shells, formed in a die, had to be punched in second operation. The die was turned to a sliding fit for the ID of the shells, and was drilled to form a clearance hole for the punch. A small stripper was located around the punch to hold the work down after the operation. The first example was quite conventional.

Round shells for another job had to be punched, too, but here a complicated shape had to be cut in the bottom of each shell. The shape of the cutout reached the edges of the shell, so a setup similar to the first one was not possible. For this job, the punch and die were reversed, and the punch was mounted, cutting edge up, on the die block. The ram carried the die itself, which was mounted off on blocks to allow clearance for the punch.

The punch was turned to a sliding fit on its OD for the ID of the shells. The stripper plate was spring-mounted to locate each shell over the punch before a ram stroke. A gravity chute on the inclined press removed slugs from the die. *Federico Strasser, Santiago de Chile.*



Spotfacing Tool Works From Drill

NORMAL SPOTFACING when the surface to be machined lies under a projection is done by inserting a spindle through a drilled hole, then keying a tool to the spindle, cutting, and finally removal of the tool and spindle. This inefficient operation can be bypassed if the spotfacing tool can be keyed to the drill which opens the hole, thus bypassing much of the hand work.

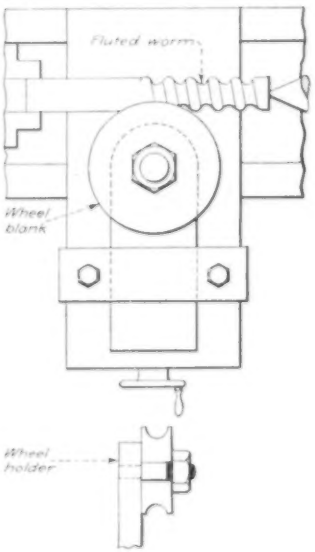
The tool illustrated has teeth cut as in a normal spotfacing tool, but it is drilled through and two small keys are added by setting them in a cross hole through the tool. After the drill has broken through the projection which has to be spotfaced on the under side, the drill is backed off slightly, the tool is held under the hole, and the drill is pushed down to engage the cutter. The keys fit in the drill flutes.

A certain amount of back pressure on the cutter will be counterbalanced by friction of the keys and drill, so shallow spotfacings can be cut in a short time. With this arrangement, the keys hold in the two flutes of the drill, and they must be fairly tight-fitting. When spotfacing is done, the drill can be dropped a little, the cutter can be hand-held, and the drill can then be withdrawn. *Joseph Alfonso, Bethlehem, Pa.*

Lathe Rig Turns Worm Wheel

WHEN NO OTHER METHOD is suitable or available, a worm wheel can be turned on a lathe with a cutter that is made from a worm.

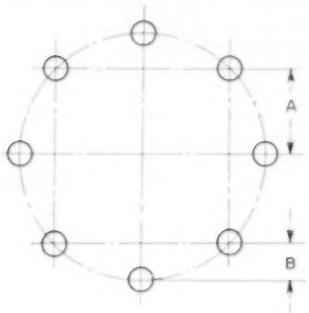
The setup is made with the cutting worm between centers and driven by a dog, or chucked at the head end and supported by the tailstock center. A simple block



holder positions the worm-wheel blank, which is turned to approximate size and shape before the milling operation. Being mounted on the cross-slide, it can be fed into the worm cutter.

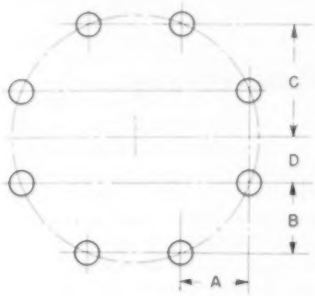
An ordinary worm can be turned to form the cutter. This is then fluted to provide cutting teeth, and is hardened. Final grinding takes care of a slight amount of clearance and the rake angle.

Because the cutter is a complete worm, it will revolve the wheel blank as it cuts as soon as the slide has fed in enough to provide small gashes on which the worm cutter can exert side pressure. For this reason, it may be helpful for the starting cut to grind a few gashes in the blank, at accurately located intervals, on which the worm can exert side pressure immediately. Feed throughout the operation should be slow so the cutter will not be snapped. *R. G. Vare, Hants, England.*



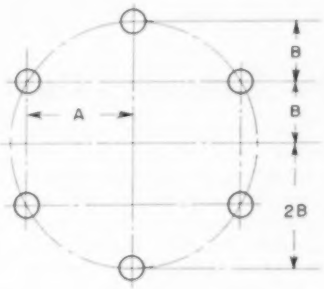
8 HOLES

DIA	A	B
1/8	0.04419	0.018306
1/4	0.08838	0.03661
3/8	0.13258	0.05491
1/2	0.17677	0.07322
5/8	0.22096	0.09153
3/4	0.26516	0.10983
7/8	0.30935	0.12814
1	0.35355	0.14645
2	0.70710	0.29290
3	1.06065	0.43935
4	1.41420	0.58580
5	1.76775	0.73225
6	2.12130	0.87870
7	2.47485	1.02515
8	2.82840	1.17160
9	3.18195	1.31805



8 HOLES

A&B	C	D
0.03382	0.05774	0.02392
0.06764	0.11548	0.04783
0.10147	0.17322	0.07175
0.13529	0.23097	0.09567
0.16912	0.28871	0.11958
0.20294	0.34645	0.14350
0.23676	0.40419	0.16742
0.27059	0.46194	0.19134
0.54118	0.92388	0.38268
0.81177	1.38582	0.57402
1.08236	1.84776	0.76536
1.35295	2.30970	0.95670
1.62354	2.77164	1.14806
1.89413	3.23358	1.33938
2.16472	3.69552	1.53072
2.43531	4.15746	1.72206



6 HOLES

A	B	DIA
0.054126	0.03125	1/8
0.10827	0.0625	1/4
0.16240	0.09375	3/8
0.21654	0.125	1/2
0.27067	0.15625	5/8
0.32481	0.1875	3/4
0.37888	0.21875	7/8
0.43301	0.250	1
0.86602	0.500	2
1.29903	0.750	3
1.73204	1.0000	4
2.16505	1.250	5
2.59806	1.500	6
3.03107	1.750	7
3.46408	2.000	8
3.89709	2.50	9

Jig-Borer Tables Establish Bolt-Circle Constants

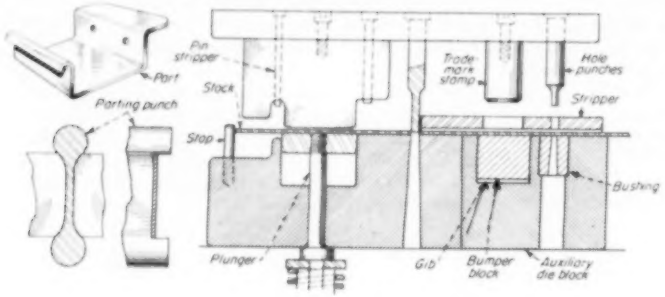
THESE TABLES make the usual chore of multiplying and adding to find bolt-circle measurements for a layout unnecessary. To the best of my knowledge, no similar tables have been published in any other reference publication.

Bolt circles with 3, 4, 6, 8, 12, or 16 holes can be spaced evenly by just picking the correct table and allowing for half or double spacing when the number of holes is half or double the number shown in the diagram with the table. The tables make it possible to do away with layout, after one centerline has been located, because jig-borer table-feed dials can be read off for the right amount of travel.

For example, with a given bolt circle of 5⅜-in. diameter and with 6 holes:

Find "a" dimension by adding the value opposite 5 in. to the value corresponding to ⅜ in. in the "a" column; or 2.16505 plus 0.16240 equals 2.32745 in. The "b" dimension can be read off in the same way under the "b" column, although in this case it is exactly half the radius of the bolt circle, or 1.34375 in. Tables for two arrangements of 8-hole circles are shown above.

When the bolt circle is more than 9 in., the dimensions can be found by adding up given values for increments that add up to the bolt-circle diameter. *W. T. La Lond, Quincy, Ill.*



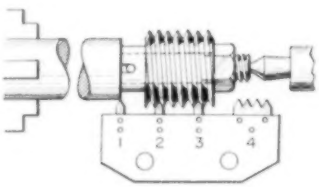
Die Completes Eight Operations

To PRODUCE small stamped parts like the one illustrated, sheet stock was fed through a compact combination die that performed piercing, stamping, parting, corner-cutting, three 90° bending, and reverse-bending operations. Stock was 1½ in. wide and 0.048 in. thick; and was fed through from a roll.

The die proper was of one-piece construction, hardened, and drawn. It contained the opening for the parting punch as well as a recess for the bending operations. On the right side of the die block a second block was mounted. This was made of mild steel, and was machined out to locate the piercing bushing and the bumper block for the trade-mark stamp. The bumper block was machined off on the bottom to mate with a take-up gib that located in the bottom of the hole. This allowed takeup during the run if the trade mark came out too faint.

The parting punch was blended at the edges to produce a radius on both ends of the stock as it was cut off. A pin stop at the left end of the die located stock as it was pushed through the die. The parting punch was formed with extensions of both edges which formed pilots that nested in suitable holes in the die. The bend-forming punch was fitted with two pin strippers, whereas the block at the right had a plate stripper.

In operation, the stock was fed into just past the parting punch and the first stroke pierced the hole, cut the stock off, and stamped the trade mark. Then the stock was fed in again until it hit the stop pin. A second stroke stamped, parted, and punched a second piece while the bending punch worked the stock down against a spring-loaded plunger in the die to form the three right-angle bends and the curl. Wide clearances were formed in the bending punch. *Walter Gabriel, Omaha, Nebr.*



Set of Form Tools Cuts Threads in One Pass

WE HAD an order for several hundred nipples like those illustrated, and these had to be threaded to an odd pitch. After they were machined all over except for the threading, each part was notched across one end.

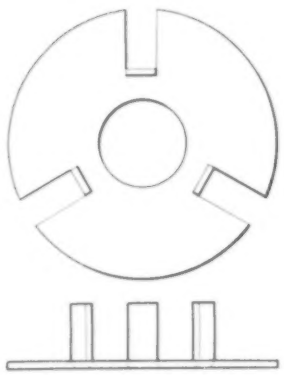
A long shouldered mandrel was made to be swung between the chuck and tailstock of a lathe. One end of this was threaded to a fast pitch so removing the nut that held work in place would be a quick operation. A cross hole drilled through the mandrel next to the shoulder was fitted with a piece of rod which acted as a key against the notched parts. The shoulder section of the mandrel was turned accurately to full thread depth.

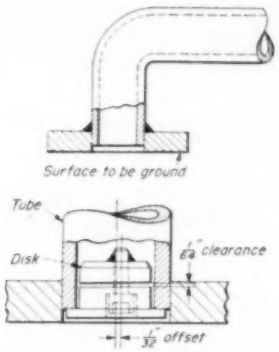
The tooling was set up on a large block on the cross-slide. The first single-point tool gashed, the second cut the leading flank almost to root diameter, the third finished the root and cut the trailing flank, and the fourth tool—an old chasing tool—produced the form.

A single pass of the carriage finished each part, thus eliminating time wasted in engaging the leadscrew time and time again for more than one pass. Tool action was gaged by watching the mandrel shoulder. When the tools cut this surface, they were fed in too far. *Dan Penway, Carlisle, England.*

Spring Sockets Made from Washers

NEEDING a few spring sockets recently, I hit upon the idea of taking some washers, making radial cuts in them with a hacksaw, and bending up the tabs that were cut. Each washer with three tabs bent up on it will hold a spring, and will also allow putting a bolt through its center hole so the socket can be fastened. Additional cuts can be made, and another set of tabs on the same washer can be sent up to form a socket on the other side of the disk, allowing two springs to be held this way. *Frank Biechele, Brooklyn, N. Y.*





Locking Plug Protects Tubing

HYDRAULIC SYSTEMS must be kept immaculately clean to prevent damage to valves and pumps, therefore it was necessary to close off tube openings when their welded joints to a flange were to be surface ground.

The plug illustrated sealed the tube opening, and yet did not interfere with the grinding job. It consisted of three parts: a flanged outer plug, a locking disk, and a socket-head capscrew welded to the disk. The assembly was permanent after machining was done.

The holes through both the plug and disk were drilled about 1/32 in. off center so that rotating the disk by means of the capscrew jammed it inside the tube; therefore holding the plug in position. Outside diameters were a slip fit on the tube and flange.

Clearance between the plug and disk was left at about 1/64 in., and the flange on the plug was made thinner than the space between the end of the tube and the face of the flange. If the plug does not drop out when loosened after a grinding operation, it can be pulled with a magnet. *H. G. Frommer, Milwaukee, Wis.*

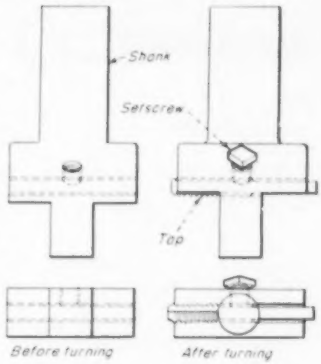
INTERNALLY SPLINED PARTS that are too tight on mating members can be quickly enlarged by dipping them in a nitric-acid bath. Acid removes metal from all surfaces. *G. H. Shapiro, Chicago, Ill.*

Tap in Special Holder Mills Serrations

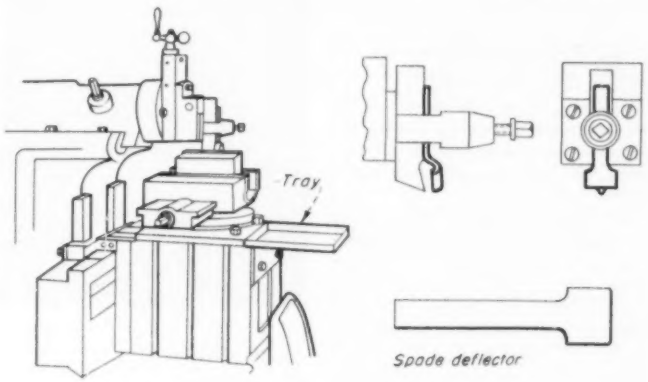
FINDING it necessary to serrate a hydraulic fitting for a gasket seal, I devised this holder that gripped a tap. The method was economical and fast.

A block was milled to shape, and a cross hole was drilled through and tapped partly through. A smaller hole was drilled and tapped at an angle to the axis of the holder to carry a setscrew in a position where it would not interfere with the action of the tool, but would clamp the tap.

In a lathe setup the block was turned down to form a round shank and a pilot to match the hydraulic fitting. The block was also faced off to expose part of the drilled - and - tapped hole. After this, the tap was backed into the hole, rotated to position where one flute was exposed so it would cut, and was clamped by a setscrew.



The tap thread was right-hand, so the drillpress in which the holder was mounted was run backwards to serrate the fitting. *Hugo Mossberg, Los Angeles, Calif.*

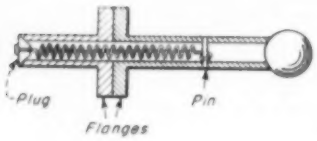


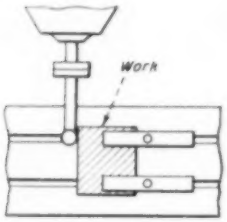
Spade Deflector Collects Shaper Chips

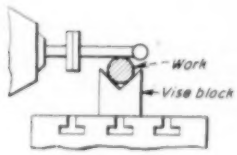
CLEAN WORKING AREAS can be promoted with a sheet-metal deflector added to the toolholder assembly of a shaper and with a chip-collecting pan added to the table.

The deflector is cut to a rough T shape, then bent to the form shown. The shank is left straight so it can be clamped on top of the toolholder in the shaper toolpost. The T end is bent offset to allow space between it and the edge of the tool, and the two ends are bent in to confine the chips. A tray is bolted to the end of the table.

As the ram operates, chips are collected between the deflector and tool and are dropped into the pan as the ram reaches the end of its stroke. When enough chips have been accumulated, the tray can be removed and dumped into a chip bin. *R. B. Wolverhampton, Staffordshire, England.*







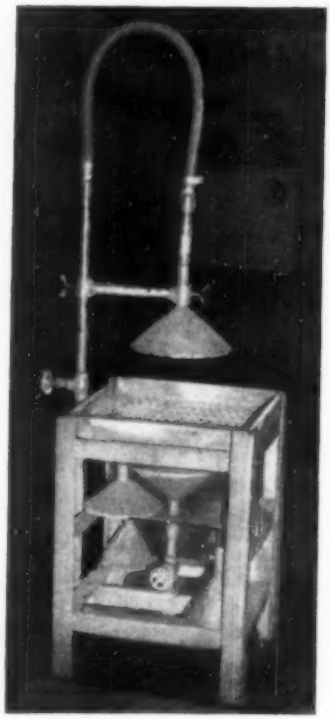
Wiggler Centers Work Under Machine Spindle

WIGGLERS are almost as varied as the toolmakers who think them up. Here is one that is somewhat unusual in that no indicator point is utilized.

It is made by fitting two pieces of tubing with flanges, or by boring and turning the two parts from solid stock. The parts are connected by a spring that provides tension between a pin through the longer tube and a plug in the end of the other. A round ball is soldered to the open end of the longer tube.

With this design it is fairly easy to bring a piece of work up to the chucked wiggler and to tell when the work touches the wiggler. As soon as the work pushes the ball or the tube (either part may be used as a contact surface), the flanges are spread slightly and light can be seen between them.

When the work on a machine table must be shifted so a hole or slot can be machined a given distance from one edge, the wiggler is chucked and the work brought up to touch it. The wiggler is then removed, and the table is shifted the given amount plus half the diameter of the ball (or half the dia of the tube, if that surface is used) toward the spindle of the machine. *Hugh Hay, Elmira, N. Y.*



Air Unit Cools Treated Parts

THIS air cooling unit was developed for use in a heat-treating department where an air cooling unit that could easily be adjusted for many different parts was needed.

Two heads, one above the expanded-metal table, and one below, can be fitted with different nozzles with openings from 1/64 to 1/16 in. Air can be directed either up or down, through either nozzle.

The unit's advantage is that it allows a large airstream to be blown over cooling parts, and does not restrict air flow. *W. A. Court, Memphis, Tenn.*

$25 *In addition to regular payment*

for the best PRACTICAL IDEA

An extra payment of $25 will be made for the best Practical Idea in each number of *American Machinist*. To avoid bias, the selection will be made by readers, a different group each time.

PAYMENT—$25 in addition to regular rates for the item as published, to be paid as soon as reader votes are received—usually three to four weeks after the date of the issue. The winner will also be announced in these pages as soon thereafter as practicable.

JUDGES — A group of 200 *American Machinist* readers is asked to select preferred articles in each issue. The group is a true cross-section of all readers, and changes entirely each time. Their votes, in addition to guiding the editors, select the best Practical Idea. If at any time their votes result in tie, $25 will be paid to each and every co-winner. Decision of the readers will be final in each case.

REQUIREMENTS—Only items in the Practical Ideas pages are eligible, and they must be submitted directly by the originator. Do not worry about your shortcomings as a draftsman, photographer or author—every item will be edited in accordance with *American Machinist* standards and suitable illustrative or explanatory material added where needed. Readers will judge only the finished product—in terms of its usefulness to them.

WHO MAY ENTER — Anyone may enter except employees of the McGraw-Hill Publishing Co., Inc., and those of advertising agencies or departments. Suggest to your employees that they submit ideas.

HOW TO ENTER—Send your entry to "Practical Ideas Editor," American Machinist, 330 West 42d St., New York 18, N. Y.

100th Winners: A Tie—
Frank Biechele
Rapid Cam Layout

Daniel Love
Threading With a Tap

TALKING SHOP

Wrapping Paper

ONE MIDWESTERN farm-machinery plant has been drawing up its own tooling on ordinary kraft wrapping paper, using tracings and blueprints only on production parts. Four big welders, for example, were rough-designed this way—pencil drawings with simple handwritten notes and dimensions. The company claims no loss of accuracy and considerable saving in time and cost.

Plane Facts

WE SHOULD ELIMINATE the concept of "top management" from our thinking, according to a prominent personnel man. He suggests a horizontal grouping, such as Operating, Middle, and Administrative Management, with the latter made up of company executives furthest from the firing line. As he puts it, "You can move around freely on a plane, but you can't move on a ladder without stepping on someone's fingers."

New Union Demand

AT A RECENT management discussion on productivity, one speaker pointed out that the use of modern power tools has, in effect, given the worker 285 slaves to toil for him. To the union representative on the panel the implication was obvious. His immediate comment was: "The next time our group gets around the bargaining table, I think we should ask for remuneration for every one of those slaves."

Plate Stops Trouble

SKF plates bronze retainers of precision roller bearings with 0.001 in. of 99.99-fine silver to act as a dry lubricant and prevent seizing in jet aircraft engines. In piston aircraft engines, races and rollers are plated with 0.0003 in. of tin to prevent rusting from water.

Jack Makes System Work

COST OF PERISHABLE TOOLS at Nordberg's plant in Milwaukee has been cut appreciably in a little more than 2 yr, primarily because Jack Veit, tool supervisor, has taken a personal interest in making sure the crib-control system is used effectively. More than 800 tools are charged out at Nordberg's tool crib each shift and normally 30 to 35 thousand tools are under crib control.

When Jack took charge of the perishable-tool crib back in 1947, Nordberg already was using the very latest in McCaskey crib-control systems, but Jack found that little attention was paid to pile-ups of broken-tool reports for a few of the machine operators, and that some operators had unusually large stacks of tool slips on the charge-out boards most of the time. In almost every case, he found that the control system was not working because no one previously had taken an interest in calling a halt when the system got out of control. Now periodic checks of the control boards and conferences with shop foremen help keep the control system under control.

$ for Ideas

STEWART-WARNER WORKERS made 4,054 suggestions in 1949, about 12% more than in 1948. Of these, 1,219 were adopted, resulting in $124,988 of first-year savings to the company. In 1948, 1,037 suggestions were adopted, resulting in $67,450 savings. 1949 payments to suggestors were $26,813, the all-time high.

Deformation

D. H. WOODWARD of the National Bureau of Standards has developed a technique which uses polarized light to make visible differences in orientation that result from deformation of a fully annealed metal. It is thus far confined to Monel, but it is expected to be applicable to other metals. When Monel specimens are given a light etch (4 sec) with the Monel Contrast Etch (aqueous solution of chromic and nitric acids in ammonium chloride), the surface of the metal becomes optically active, so polarized light can be used to detect differences in grain orientation.

Busy Signal

AN OFFICE-MACHINE SALESMAN took a prospective customer into a room in which many office machines were operating. "Terribly noisy," complained the prospect. "That's not noise, that's production," replied the salesman.

$64 Answer

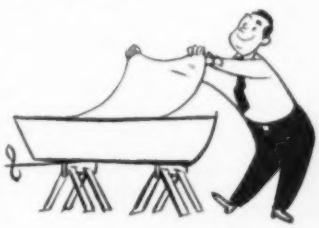
WHAT WOULD YOU DO if taken to a plant with which you were not familiar and told to do just *one* thing to effect a maximum increase in productivity? Probably the best answer from the panel to which this question was put, came from a works manager of long factory experience: "I'd build my first and second line supervision into the most effective, hard-hitting team I could put on the field."

Penny-wise Policy

DISCUSSIONS on productivity invariably get around to technological unemployment. But a new angle came up at a recent meeting: According to a well-known statistician most companies install labor-saving equipment when business is good and they can absorb the displaced workers in other parts of the plant. It's the company that fails to replace obsolete equipment that goes on the rocks and thus puts people out of work.

New Skin

RICK KELLER, son of K. T. Keller of Chrysler, is a motorboat racing enthusiast. He has developed an entirely new hull-skin construction for his 1950 boat which gives much greater strength with 60% of the weight of an all-wood job. Inside and outside layers of glass cloth are applied over 3-ply waterproof Weldwood. No paint or varnish is required to finish.



• **NEW MILL** of U.S. Steel's National Tube Co., McKeesport, Pa., has begun making pipe large enough to deliver 344 million cubic feet of gas every 24 hours. Mill is geared to turn out annually 100,000 tons of electric welded and hydraulically expanded steel pipe, ranging up to 36-in.-dia. Initial production is on an order for 30-in. size.

• **HOLLOW STEEL** 19-ft flash-welded propeller suitable for quantity production is under development at Air Materiel Command, Dayton. At same time Air Force is attempting to improve production techniques of these blades. One of the type has completed a run-out at 21,000 psi on a resonant fatigue machine. Engine tests are due soon.

• **ELECTRIC CONTACTS** or "brushes," made of graphite and used to feed current to moving parts in motors or generators on high-altitude aircraft, may have their useful life increased thousands of times through new lubrication methods devised by General Electric.

• **SELF-PROPELLED** and steerable "tug" has been proposed by Boeing Airplane Co. as possible answer to problem of ground handling and moving of commercial jet transports to takeoff position. Vehicle would utilize Boeing's new gas turbine geared to two rollers bearing against main gear and utilizing airplane's weight for traction.

• **OF SMALLER METALWORKING** companies (employing 200-5000 workers), only one third provided for new or improved pension benefits, March BLS survey of 110 contract settlements showed. Half granted social insurance concessions. More than 40 included general wage increases for 35,000 workers.

• **EQUIPMENT AND WEAPONS** totaling 2500 items are given priorities for production planning in new "Production Allocation Manual" published by Munitions Board, Dept. of Defense. Allocation program is designed to make possible quick changeover from peacetime to wartime production.

German Machine Tool Plants Taken By Soviet Reborn in Western Zone

NEW YORK—Almost 50% of those German machine-tool builders who found themselves behind the Iron Curtain when Germany was partitioned (the partitioning placed half of all tool plants in the Soviet zone, half in western areas) have now been restarted in west Germany—in most cases because Soviets dismantled their plants. Most of the others, still behind the Iron Curtain, are said to have copies of their designs on file in west Germany, in case they share the same fate. The German machine-tool association has established a cooperative plan to aid these emigres.

This was revealed by Jerome A. Raterman, president, Monarch Machine Tool Co., upon his return to this country May 16. He had been in Europe for the past three months, visiting 11 countries of western Europe (all but Norway, Spain and Portugal).

He visited three of the four major industrial fairs this spring, missing only the Leipzig Fair, to which west European visitors were invited, but which nonetheless was limited almost entirely to east European exhibitors. The Basle Fair was all Swiss, and showed little, if anything, new in machine tools.

• **At Hanover,** there were many machine tools, many of them new. They indicate re-emergence of Germany as the leading European machine-tool exporter within a relatively short time.

Most German machine-tool plants were bombed out, hence have done a remarkable job of recuperating since 1945. They appear to be ten years behind current American practice—not at all bad considering that it was anywhere from 1947 to 1949 before they began producing again. Incidentally machine-tool builders in the Occupied Zone are building tools for export to Russian satellites — something American builders are not permitted to do.

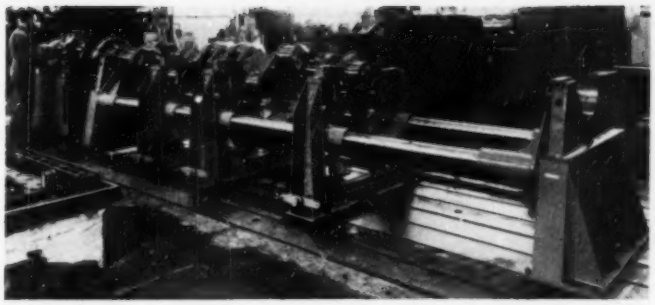
At Milan, 34 Italian lathe manufacturers exhibited 90 different types, of a total of 48 exhibitors of 104 types. Indications are that the top 4 or 5 Italian displays are good machines, the rest of very low quality. Italy has currently a sizable machine-tool industry — witness 34 lathe builders against 16 in the U.S. —but many are copies of U.S. or German machines.

• **Europe in general** suffers from shortage of, and generally poor, materials. Even cast iron is of much poorer quality than the American product, making machining correspondingly harder. Labor costs are far lower—in Germany, for example, operators work for 1/5 to 1/6 our rates (1 mark for operators, 1 mark 20 pfennig for skilled mechanics). Tools and facilities, of course, are much poorer and quantities smaller.

In contrast to opinion a year or two ago, most European industrialists now feel that German industrial and technical ability must be used to aid Europe's recovery.

• **All machine-tool plants** in Europe are currently busy—backlogs in France, Sweden, Italy and Belgium are larger than those in the U.S. (The Swiss are having trouble because of the high price of the Swiss franc since devaluation.) Current export sales are to southeastern Europe and to Africa in particular.

DANISH-MADE Marshall Cycle is presented to Dan G. Fichter, vice president, Federal Bearings Co., Inc., Poughkeepsie, N. Y., by Lauritz Hansens, director of Hede Nielsens, Ltd., Jutland, Denmark, bicycle maker whose plant would have closed but for arrival through ECA of vitally needed steel balls from Federal's Waterbury Steel Ball Division



DIESEL SHOP of Baldwin Locomotive Works at Eddystone, Pa., is now using this Gisholt Dynetric Type 6-UH balancing machine. Shown mounted in machine is the 4790-lb crankshaft used with 8-cylinder super charged diesel engine. Amount and location of dynamic unbalance is measured to accuracy of one pound-inch. This is equivalent to a measurable displacement of .0002 in. at either end of the holding cradle

Used Machinery Dealers Urged to Go After Business in ECA Countries

DETROIT—There is definitely business to be obtained by used equipment dealers in the 18 participating ECA countries, George H. Knutson, chief of the Industry Division of ECA, told members of the Machinery Dealers' National Assn., at the group's annual meeting here May 11.

The U.S. has availability, delivery, and productivity necessary to do a good job in selling to Europe, Mr. Knutson said, adding that ECA can only be of assistance to dealers and manufacturers in this country; it will be up to the individual companies to go after the business.

Productivity centers are being started in Europe by ECA to increase production in pacticipating countries, Mr. Knutson revealed.

• **A list of projects** in Marshall Plan nations for which ECA dollars have been approved was prepared by Mr. Knutson for distribution to MDNA members. Each project, some running into hundreds of millions of dollars, has a potential market for machine tools, it was explained by J. M. P. Fox, executive director of MDNA.

Majority of the projects are steel mills, a good many are power plants, some involve mechanization of coal mines. One French project, with an over-all value of $8.6 million, involves machine tools and industrial equipment for Schneider & Co. In Italy, a $43.7-million project is for machinery and equipment for manufacture of autos, trucks, tractors, diesels, railway stock, etc., for Fiat at Turin. In addition, there's a $15-million project involving steel plant equipment for Fiat.

• **Some of the larger projects:** France—equipment for potash mines domainiales de Potasse d'Alsace, $125,000,000, and steel plant equipment at Hayange and Ebange for SOLLAC, $113,060,000; Italy—Steel mill equipment for ILVA (Finsider) at Bagnuli and Piombiono and SIAC (Finsider) at Cornigliano, $111,000,000; Netherlands—steel plant equipment for Royal Dutch blast furnace and steel Co. at Ijmuiden, $47,000,000; Turkey—improvement of Turkish National Highway System, $58,000,000; United Kingdom—equipment for Steel Co. of Wales, Ltd., at Margram and Troste, South Wales, $240,000,000.

Burnham Finney, editor, AMERICAN MACHINIST, spoke at the luncheon. May 10, explaining the significance of the Midcentury Inventory of Metalworking Production Equipment.

• **New officers** announced for the ensuing year are: president, Frank Laurens of Laurens Bros., Cincinnati; first vice president, Joseph T. Weiss, Interstate Machinery Co., Inc., Chicago; second vice president, Letcher Bennett of Bennett Machinery Co., New York; and treasurer, William Howarth, International Machinery Co., Detroit.

Sales Agents Named

Precision Welder & Machine Co., Cincinnati, has appointed Upton, Bradeen & James, Ltd., Montreal, as exclusive representative in Canada. Arcos, Inc., Philadelphia, has been named representative in eastern Pennsylvania, southern New Jersey, Delaware, Maryland, Washington, D. C., and eastern Virginia.

Federal Machine & Welder Co., Warren, Ohio, has appointed Austin-Hastings Co., Inc., Cambridge, Mass., as district representative in Maine, Vermont, Massachusetts, New Hampshire, Connecticut and Rhode Island.

Automatic Transportation Co., Chicago, has appointed Nelson Equipment Distributors, Indianapolis, sales representative in Indiana, except for the South Bend area and those counties near Louisville, Ky.

E. W. Bliss Co., Toledo, has appointed Steel City Tool & Machinery Co., Inc., Pittsburgh, as sales representative in portions of western Pennsylvaina and southeastern Ohio. Coincident to this move, Bliss is closing its sales office at Pittsburgh.

Carboloy Co., Inc., Detroit, has appointed the following distributors: Tools & Supplies, Inc., St. Louis, for St. Louis and vicinity; Erie Mfg. & Supply Corp., Erie Pa., for Erie and northwestern Pennsylvania.

MEETINGS

May 29 - June 9 — Canadian international Trade Fair; Toronto, Ont.

June 1-2—American Society for Quality Control, national convention and midwest conference, Milwaukee Auditorium.

June 4-9—Society of Automotive Engineers, summer meeting; French Lick Springs Hotel, French Lick, Ind.

June 5-7—American Gear Manufacturers Association, annual meeting; The Homestead, Hot Springs, Va.

June 12-16—American Electroplaters' Society, international conference on electrodeposition; Hotel Statler, Boston.

June 12-16—American Institute of Electrical Engineers, summer and Pacific general meeting; Huntington Hotel, Pasadena, Calif.

June 15-17—Material Handling Institute, meeting; Greenbrier Hotel, White Sulphur Springs, W. Va.

June 19-23—American Society of Mechanical Engineers, semiannual meeting; Hotel Statler, St. Louis.

June 22-23—Malleable Founders' Society, annual meeting; The Homestead, Hot Springs, Va.

June 26-30—American Society for Testing Materials, annual meeting and exhibit; Chalfonte-Haddon Hall, Atlantic City, N. J.

• **1952 TOOL SHOW** will be held at the Chicago Amphitheater, week of March 17, ASTE has announced. A considerable number of space reservations have already been received for the show. Total registration for this year's show at Philadelphia was 18,483, ASTE reports.

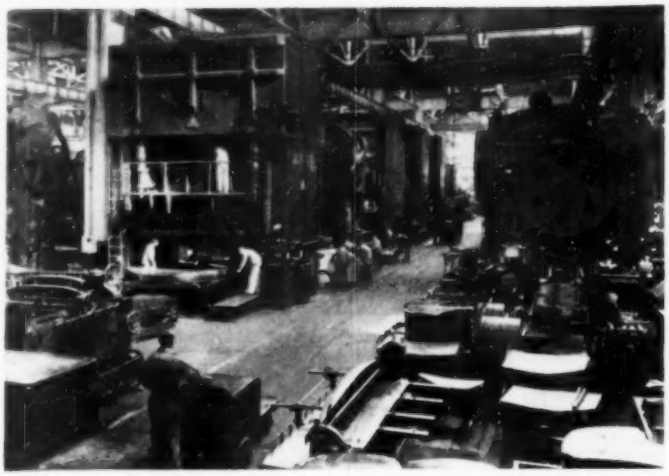
• **DEBATE ON MACHINES AND JOBS** is something CIO doesn't dare risk, Tell Berna, general manager, NMTBA, told members of Hungry Club, Pittsburgh, May 8, because statements of Phil Murray that introduction of new machinery causes extensive layoffs are "unsupportable." "It is a matter of economic history that by and large over the years, jobs have increased in direct ratio to mechanization," Mr. Berna said. He urged that Mr. Murray "investigate and correct union restrictions on productivity which forbid the operator to get out of a good new machine the production potentialties that are built into it."

• **NEW DIESEL LOCOMOTIVES** worth $17.5 million have been ordered by Southern Pacific Railroad. Latest order is for 36, of which 24 will be 6000 hp and 12 will be 1500 hp. General Motors' Electromotive Div. will build 22 units for freight service. American Locomotive Co. will build two for passenger service, and Baldwin will build the 12 1500 hp locomotives for freight service. Deliveries will begin in July.

• **GENERAL ELECTRIC CO.** will prepay on July 3 the remaining $42.5 million of a $200 million financing program arranged in 1946 to help finance its postwar reconversion, expansion, and improvement projects.

• **MORE COLOR HARMONY** in standard industrial equipment finishes through unanimous agreement reached on four accurately defined grays as standard finishes, American Standards Assn. reports. The four: light gray, medium light gray, medium dark gray, and dark gray. Medium light gray closely approximates Machine Tool Gray (7B), a standard of NMTBA.

• **TEXTILE INDUSTRY** will spend upwards of $300 million in next year in drive to cut production, cut costs, it is predicted by Richard H. DeMott, vice president of SKF Industries, Inc.



PRESSING OF BODY SECTIONS goes on here at the Mirafiori Automobile Works at an increasingly stepped-up pace as the . . .

New Fiat "1400" Heads Italy's Drive for World Auto Markets

ROME (McGraw-Hill World News) —Brightest candle on 50th birthday cake of Fiat's Mirafiori Automobile Works, Turin, is the new "1400" auto with which Fiat heads Italy's drive for world markets. It's the company's first really new postwar model.

Fiat is strengthening its already world-wide sales organization, with particular emphasis on South American, South African, Australian and Indian markets, in order to push this new 4-cylinder, 4-door model with its American-type body and European-economy motor.

Fiat gives Marshall Plan aid much of the credit for producing this new car, on which work began in 1946. Mirafiori Works has obtained through the aid program some 350 of the latest American machine tools, valued at "some millions of dollars," on long-term low-interest conditions.

• **The modern Mirafiori Works** shows what can be done by wise investment in a country which lacks natural resources but has an ample supply of manpower. Fifty years ago, Giovanni Agnelli with a group of Turin businessmen started producing autos at the foot of the snow-covered Alps. By successive increases in capital Fiat has developed into the largest industrial group in Italy, and one of the largest in Europe.

Today Fiat works mines, owns iron and steel works, non-ferrous metals foundry, produces motor vehicles of all kinds, tractors, large diesel engines for ships and powerhouses, railway rolling stock, domestic refrigerators and other appliances, machine tools and lubricants. It also controls the largest motor transport company in Italy, using only Fiat buses and trucks, of course.

• **It's a limited liability company,** majority of shares owned by the founder's family. The organization suffered some 25 billion lire damage during the war, but such is its wealth that it made this good without government aid.

The Mirafiori Automobile Works supplies its own power from the most up-to-date private generating plant in Italy. All equipment is of Italian make, and the two huge diesel motors which supply one-fifth of this power were constructed in another Fiat plant, Fiat Grandi Motori. The other four-fifths is supplied by steam turbines. The steam is afterwards utilized for driving the pneumatic hammers and for heating purposes.

Internal factory transport is of very high standard for Europe. Electric handling and lifting trucks, and overhead runways are extensively used. Main aisles are wide enough

ASSEMBLY LINES show, on right, new "1400". On left is "Topolino" line, a popular baby 2-seater. Further to left is third assembly line for "1100" 4-seater

to enable executives or visitors to drive right through the works by auto.

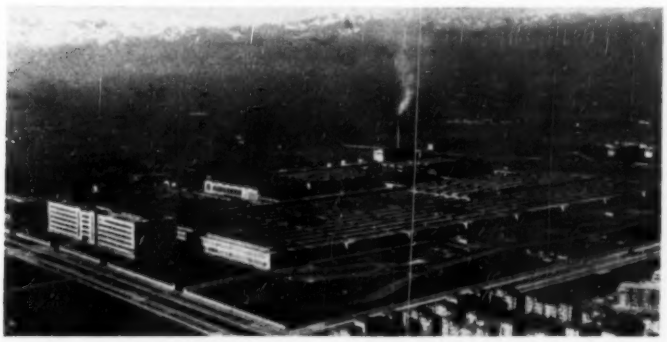
• **The well laid-out plant** has feeder transverse lines running from both sides of the building towards the center where the three main assembly lines run right down the building. ERP machines are conspicuous in their light gray paint. Daily output is 400 autos, 228 of these being the baby 2-seater Topolino (500 cc), the rest the Berlin 1100 cc model, and the new 1400.

The Topolino line is 700 ft long and moves at 7 ft a minute. It takes 80 minutes from beginning to when the finished model is driven out to the test track. Every fourth or fifth chassis is left without a body, to be fitted with a station wagon body or special custom style.

The new 1400 line is shorter than the 500, as it has an integral body. The body and mechanical units are quite separate and can be taken apart by unscrewing only 18 bolts. Radiator, clutch, engine, gearbox, axle, spring and wheel are joined to bottom of body by 8 bolts. Rear group (rear axle, springs and wheels) is secured by 8 bolts. In between these two groups the transmission is fixed through the central support (2 bolts).

• **Body is pressed in one piece,** using machinery which came partly from the Budd Corp., Philadelphia, partly from Britain's Pressed Steel Co. Fiat makes everything but the tires, clutch and brake linings.

The "1400" combines comforts of a large car with advantages of a small car. It has a full-width 51-in. front seat, with gear lever on steering column, good visibility, safety glass heater, and enclosed baggage space with spare tire. Fiat claims over 75 mph for the new car. Consumption is 22 miles to U. S. gallon.



MIRAFIORI AUTOMOBILE WORKS at Turin, showing private test track in foreground. From head office building at left fifteen different Fiat companies as well as the auto factory are controlled. Workers enter main building through subways under private track leading to top floor where change rooms and cafeteria are located

Industrial Briefs...

• **DeVilbiss Co.,** Toledo, will open a new assembling, warehousing and distributing plant in Santa Clara, Calif., about June 1, serving territory covered by DeVilbiss sales branches in San Francisco, Los Angeles, and Salt Lake City.

• **Ford Motor Co.** is establishing temporary offices in the plant of Cincinnati Bickford Tool Co., leasing 10,000 sq ft of floor space. The offices will be temporary headquarters for the transmission plant Ford will build in Cincinnati.

• **Automatic Steel Products, Inc.,** Canton, Ohio, has taken over active management of Cleveland Tapping Machine Co., Hartville, Ohio, and will continue its operation under that name.

• **William R. Whittaker Co., Ltd.,** manufacturer of shut-off valves for aircraft use, has purchased the entire capital stock of Saval, Inc., Los Angeles manufacturer of high-pressure control valves. Both firms will continue to operate independently.

• **Whirl-A-Way Motors, Inc.,** Dayton, has been dissolved and has transferred its assets and business to its sole shareholder, A. O. Smith Corp., Milwaukee. The Dayton firm is now the Eastern Motor Division of A. O. Smith Corp.

• **Heller Brothers Co.,** Newcomerstown, Ohio, has consolidated manufacturing operations with that of its subsidiary, American Swiss File & Tool Co., Elizabeth, N. J. American Swiss will continue operations as a separate unit, moving operations to Newcomerstown.

• **National Electric Products Corp.,** Pittburgh, has purchased I. A. Bennett & Co., Chicago, National's sales agent in 15 midwestern states for 46 years.

• **Continental Can Co.** plans construction of a $2 million plant and warehouse in the heart of Los Angeles' fish canning industry located on Terminal Island. In addition to supplying nearby canneries, the firm also plans to supply various types of containers to users throughout the West.

• **Solar Aircraft Co.,** San Diego, is completing an expansion program which will add nearly 75,000 sq ft to its covered area.

• **MACHINES CREATE JOBS,** William J. Kelly, president of MAPI, declared May 16 in opening a 3-day industrial conference sponsored by Pennsylvania State College. "Mechanization not only lifts our productivity and eases the burden of labor, but also is a net creator of employment," he said, pointing out that in the last century our national production has increased almost 30 fold while our labor force has increased less than 10 fold. "During the same period the industrial week has declined from 70 hours to 41. There was a 5-fold increase in output per manhour, yet there are more jobs in proportion to population today than in 1850."

• **NATIONAL SCREW MACHINE** Products Assn., meeting at Bedford Springs, Pa., May 21-24, elected the following officers: Cecil E. Lucas, Lucas Screw Products, Inc., Rochester, president; Harry F. Fischer, Fischer Special Mfg. Co., Cincinnati, vice president; William N. Grass, M. J. Grass Screw Machine Products Co., Buffalo, treasurer. New directors elected for two-year terms: Otto Albrecht, Babson-Dow Mfg. Co., Roxbury, Mass.; E. A. Bartlein, Western Machine Co., Milwaukee; K. E. Brooks, Huron Automatic Screw Co., Port Huron, Mich.; S. E. Casson, National Acme Co., Detroit; Harold C. Close, Waterville Mfg. Co., Waterville, Conn.; George L. Hunt, Hunt Screw & Mfg. Co., Chicago; Ralph H. Lightner, Titan Metal Mfg. Co., Bellefonte, Pa.; and C. R. Wedler, Jr., Wedler Bros., Inc., Cleveland.

• **CUTTING TOOL** Manufacturers Assn., meeting in Detroit May 11, heard from L. S. Aspinwall, pension trust consultant, that individual manfacturers should take initiative in investigating whether pensions could be effectively set up in their own businesses. In discussing types of pension plans, he warned against trying, at the same time, to guarantee both fixed pension sums and also specifying fixed contributions on either an hourly or percentage of payroll basis.

• **HOW MAPI FORMULA** should be applied to replace obsolete machines was explained to several hundred New York-area industrial executives at MAPI region meeting May 23, one of a series being held in principal cities to put the replacement formula into practical use in industry. (See article, page 126.)

JOB OPPORTUNITIES in local industries were listed for high school students at Mahoning-Shenango Valleys 1950 Industrial Exposition, each exhibitor noting in his display the jobs to be found in his field. Some 15,000 adults and 10,000 students attended the exposition

96-Company Group Tells Its

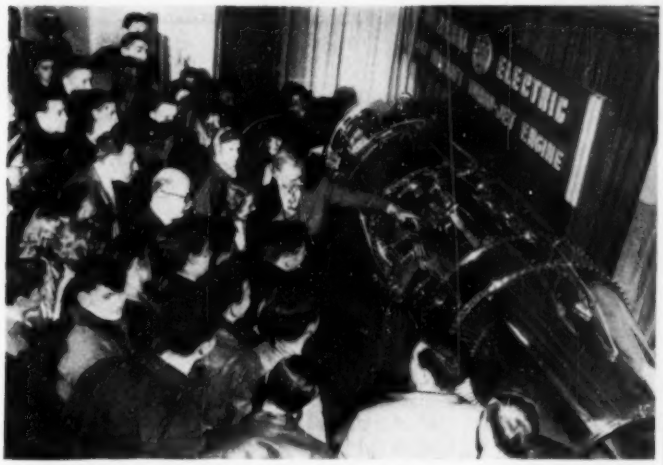
YOUNGSTOWN, Ohio — Approximately 15,000 adults and 10,000 high school students from the 4-county area surrounding Youngstown, Ohio, recently attended the second annual exposition sponsored in that city by the Industrial Information Institute, Inc. Staged primarily to show teen-agers types of jobs to be found in home industries, the exposition is only one of many informational activities undertaken.

• **Purposes of the Institute,** which is made up of 96 companies in the area and is known locally as the 4-I's, are these: (1) to make clear how everyone in the 4-county area makes his living and that the individual's prosperity depends upon continuous production; (2) to help residents (particularly younger people) realize that job opportunities are unexcelled right at home; (3) to correct misconceptions with respect to industrial ownership and profits; (4) to accomplish purposes by presenting basic economic facts through already established means.

From its inception, the organization has waged a two-pronged offensive, one pointed toward the adult, the other toward school students. Education on what the U.S. free-enterprise system is, and what it means to each individual, starts, insofar as the 4-I membership is concerned, in the third grade and continues through senior high school.

Realizing that school teachers lacked special tools needed to combat insidious and destructive influences, officers and special committees of the 4-I's met with school officials shortly after the organization came into being. No packaged aids were offered: rather, school officials were asked what was needed. When the reply was supplementary reading materials in book form, which would be devoted to an understanding of kinds of work and variety of products to be found in the 4-county industrial area, the organization promptly commissioned Howard C. Aley, an experienced school teacher, to write a series of books that would be acceptable and useful from the third grade on.

• **Five books now are available** for use in grades three through six: "Interesting People of Our Community," "Our Neighbors Tell Us About Their Work," "Exploring Our Neighborhood With Our Friends," "Beginnings of Our Community," and "Working Together We Serve the World." Books for higher grades will follow until 11 will be in use.



TURBO-JET ENGINE drew crowds of school children to American Welding & Manufacturing Company's exhibit. They saw how company's steel rings go into G-E engine, and learned of job opportunities made possible by such manufacturing concerns in their own communities

Story to the Community

Schools pay a flat 60¢ for each book, which costs 4-I an average of $1.60.

Because of these books students by the time they graduate will have the complete story of the community and its people, plus the answer to five most troublesome assertions for industry and business to answer: (1) Industry makes too much profit. (2) Stockholders and management profit unfairly. (3) Workmen get very little out of their jobs. (4) Industry is selfish and self-seeking (5) Industry is opposed to social progress.

• **Outside classroom activities** sponsored by the 4-I's and aimed at juveniles, include a series of movies showing the activities of the people in the 4-county area. Two of a projected series of sound movies have been completed: "Our Valleys Are Greener" (in color) and "The Right Road." Cost of producing the movies was held to about $2000 each, with half of that cost going for sound dubbing and prints. Scenes were taken in various plants under actual working conditions with regular workmen for the cast. Reception by the public has been enthusiastic.

To get its story of free enterprise across to adults, the 4-I organization relies heavily on member companies, providing them with ammunition to be disseminated to employees by bulletin boards, employee publications, or through supervisory channels. At least two of the larger employer members have plans well under way for educational courses for their supervisory employees and upon whom they will depend to get the facts before the work-level employees.

• **Plant visits** have been conducted for members of influential groups, including ministers, teachers, and civic leaders, to secure their cooperation. To secure honest and correct answers to questions members of such local groups might propound meant extensive and meticulous surveys on profits, employee attitudes, employee relations, and social progress. Reaction from members of such groups has been most encouraging.

Member company dues are based on number of employees but copies of all reports, surveys, studies, and plans of 4-I also go to non-member companies in the area.

• **A major accomplishment** of fostering and furthering the free enterprise system in the minds of the general public is a general friendlier feeling existing between all levels.

Sales Agents Named

Air Reduction Sales Co., New York, has appointed Wright Welding Supply, Des Moines, Iowa, authorized dealer of Airco products.

Eriez Mfg. Co., Erie, Pa., has named Dick Dietrich, 1355 Market St., San Francisco, exclusive west coast textile sales agent for Eriez permanent magnetic separators.

Electric Products Co., Cleveland, has appointed Vincent J. Brown Co., Buffalo and Syracuse, as district representative for New York State excluding metropolitan New York City. Klass Co., Minneapolis, has been named representative for Minnesota, North and South Dakota, and western counties of Wisconsin.

Unimax Switch Div. of W. L. Maxson Corp., New York, has appointed the following representatives: Mark M. Hennessy, Mae Strauss Associates, Milwaukee, for Wisconsin; H. W. Walton, Francis Palms Bldg., Detroit, for Michigan.

Taft-Peirce Mfg. Co., Woonsocket, R. I., has appointed Tool Supply & Engineering Co., Dallas, as its representative in the Dallas, Fort Worth and northern Texas areas.

Baker-Raulang Co.'s Baker Industrial Truck Division, Cleveland, has appointed Dillon Scale & Equipment Co., Dallas, as its district representative for all but the southeast portion of Texas.

Whiton Machine Co., New London, Conn., has appointed the following dealers to handle sales of its products in their various areas: American Steel & Supply Co., Chicago; Hibbard, Spencer, Bartlett Co., Evanston, Ill.; Keiser-Van Leer Co., Bloomington, Ill.; Clarke F. Sanford & Co., St. Louis; South Bend Supply Co., St. Louis; Industrial Equipment & Supply Co., Benton Harbor, Mich., Miles Machinery Co., Saginaw, Mich.; Howard & Smith, Inc., Detroit; McKee-Kenyon & Co., Detroit; Neill-LaVielle Supply Co., Louisville, Ky.; Steel City Tool & Supply Co., Pittsburgh.

Riverside Metal Co., Riverside, N. J., has named Clifford Metal Sales Co., Providence, as a warehousing distributor in the Rhode Island area.

Washington

What wage information a union can get from you is pretty much detailed in a series of pro-union decisions handed down by NLRB. Here they are:

A list of all employees covered by the union contract, along with their department, pay-roll number, present wage, previous wage, and performance rating points. (B. F. Goodrich.)

This same information for at least a year prior to beginning of negotiations. (Yawman & Erbe Mfg.)

"Full information" on merit wage increases. (General controls.)

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Look for mobilization plans to start rolling after July 8 when Reorganization Plan 25 goes into effect. It gives NSRB Chairman W. Stuart Symington sole power of decision over what the war planning agency recommends. The seven-man board of cabinet officers will be reduced to an advisory role, thus breaking NSRB's biggest bottleneck.

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Navy's Viking Rocket that bit off a 106-mile high chunk of altitude after being launched from the deck of a ship is designed to top the 200-mile mark. However, Navy's primary interest is to get more instruments aboard each flight to the critical 100-to-125 mile area.

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More dollars for defense, both at home and abroad —that's been assured by decisions reached during recent North Atlantic Pact talks. Arms aid totals for 1951 won't go up any from the $1,250-million now planned. But the figure being talked for 1952 is $3-billion.

Meanwhile, Congress is all set to add $350-million for aircraft to the $13.2-million asked for U. S. defense in 1951. In 1952 the jump will be even greater. NSRB has the job of deciding just how big the jump will be.

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Economic aid to the western world after 1952 (the date ECA expires) is almost certain now that NAP nations have decided to put teeth into western Europe's defenses. Chances are, however, dollar aid emphasis will shift to the colonies.

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Move is on to centralize release of non-secret reports from military research. Object is to increase the flow of information to industry. Central Air Documents Office, Wright Feld, will probably be expanded to do the job.

Defeat of Mr. Truman's Reorganization Plan No. 12 assures that Taft-Hartley won't be touched this year. It also means no labor legislation that's not acceptable to Sen. Taft.

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NLRB General Counsel Denham won't quit until after elections. He will probably resign then, even though his term runs through 1951. NLRB Chairman Paul M. Herzog may go before Mr. Denham. He says he doesn't want reappointment when his term expires in August.

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Depreciation allowances for tax purposes on gifts of plants, etc., are O.K. The Supreme Court ruled that way in reversing Bureau of Internal Revenue in the Brown Shoe Co. case. The company claimed deductions on $971,030 worth of property donated as inducements to locate in certain towns.

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Treasury's thumbs-down rule on tax deductions for pension contributions when more than 30% of such contributions will benefit employee-stockholders no longer holds. Under a new ruling BIR will O.K. or reject each case on its own merits.

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Excise tax cut proposals in the House are pretty much set at $1.1-billion. Next hurdle is the Senate Finance committee which isn't sure just what it will do. It won't even get to excises until mid-June, and might even fail to get a bill through.

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Plan to reorganize RFC under the Commerce Department means an end to RFC as you once knew it. Instead of the bustling big banker operation of Jesse Jones fame, it's to be part of Mr. Truman's program to aid small business. That means smaller loans, less collateral, and a longer time to pay.

Two other small business aids Mr. Truman suggested to Congress include: Federal insurance of bank loans up to $25,000 for not more than five years (stands some chance this year); and the federally chartered capital bank idea to provide equity capital and long term loans.

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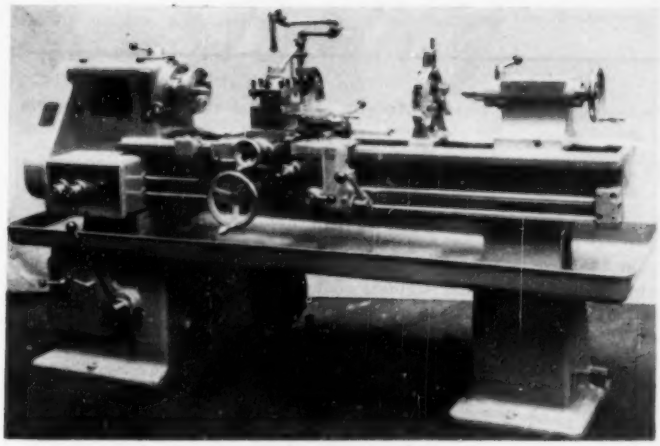
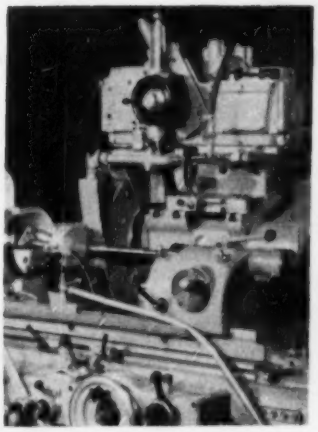
Does compulsory unionism mean what it says? Not exactly. In two recent decisions NLRB ruled: (1) a union can require a worker to pay "dues" to keep his job; but still deny him union membership; (2) a worker can offer to pay "dues" and refuse to join the union.



LUDWIG LOEWE'S feed rod lathe with 175-mm height of centers and 600 mm between centers achieves speeds up to 3500 rpm. Hydraulic duplicator (not shown) is available as attachment. Duplicator toolholder is mounted at rear of cross slide, without disturbing standard toolholder



FORTUNA WERK'S precision cylindrical grinding machine SF 1000 with automatic gaging and control device achieves precision of 0.0004 in. Grinding wheel is adjusted to the feed mechanism until pre-set measurement (0 to 0.003 in.) is obtained. At this moment control mechanism changes speed of feed. Hydraulic wheel truing attachment allows truing of grinding wheels with cylindrical, conical, stepped, or curved surface

New Machine Tools at Hanover Fair

HANOVER — Germany's largest post-war exhibit of machine tools, representing products of approximately 200 west German and west Berlin firms, was a feature of the 12-day heavy industries fair which opened here May 3.

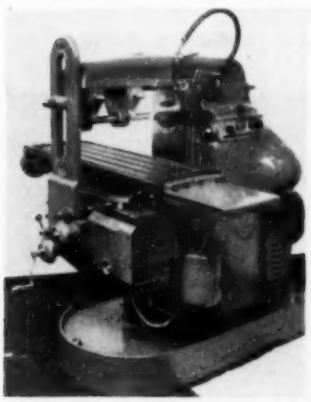
Due to the "iron curtain," Hanover has replaced Leipzig as Germany's leading technical fair. This year it serves to underscore the dramatic recovery of western zones, which in March reached the 1936 general industrial index level for the first time. Machine tool production, however, lagged around 70% due chiefly to the poor domestic buying as a result of the shortage of capital.

• **Commenting on machine tool trends** in the Hanover exhibits, Professors O. Kienzle of Hanover and C. Stromberger of Darmstadt wrote in a special joint issue of the German publications, "Werksstattstechnik und Maschinenbau" and "Werkstatt und Betrieb":

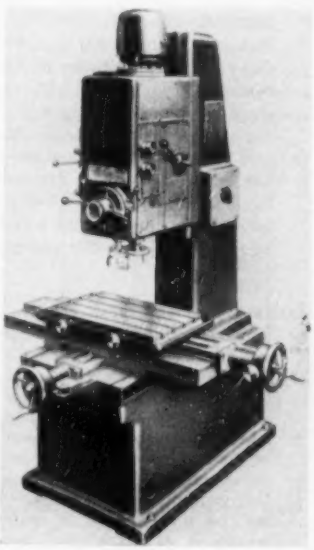
"Particular attention has been given to the simple and unhampered operation of the control and traverse levers. It has been realized that handling time has to be reduced in keeping with the reduction in productive time made possible by use of high-speed tools.

"A new branch of German machine tools has been introduced by the so-called building-block machines. It has been realized that in many cases of mass production the utilization of high class universal machinery is not feasible; that many of its requirements are met best by simple units built together into one machine. For work which has to go through several operations without being changed, these machines are made up of several simultaneously or successively acting units which are automatically controlled."

• **Increased use of tungsten carbide** in German machine tool construction was noted at the Hanover exhibits.



FRITZ WERNER'S multipurpose milling machine No. 8102, with single lever control, longitudinal power traverse and longitudinal rapid power traverse forward and return. Machine has 20 spindle speeds and 32 feeds, independently adjustable through change gears



ABA-WERK'S newly developed jig borer bridges gap between expensive large jig borer and normal precision boring machine. Sliding gear drive permits 12 geometrically progressed spindle speeds of 33 to 1500 rpm. Spindle sleeve and boring spindle are fitted specially for exact boring with Morse taper bore and super precision antifriction bearing

Detroit

Largest new tooling program currently coming out of the automobile industry is the doubling of facilities for Powerglide automatic transmission production by Chevrolet Motor Div. of General Motors.

Equipment is on order and will be purchased for manufacturing operations at Cleveland, Flint, Detroit, Saginaw, Bay City, Buffalo and Toledo. It is estimated about 300 more machines will be required for Cleveland alone—largest single manufacturing point—plus at least a few hundred at the other plants. The company is giving no estimates of their value, but unofficial sources place total bill at close to $10,000,000.

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Machine tool companies are being asked for delivery in 90 days whenever possible, and within five to six months at the very latest. Hardest to get, say trade reports, are drilling and transfer machines. Once the complete complement of new equipment is installed, output will be raised as rapidly as possible from the present 1,050 a day (on a two-shift basis) up to about 2,000 a day.

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These figures provide some interesting food for thought. They will make it possible to build Powerglides for more than 50% of the Deluxe Chevrolets made. In the past whenever any accessory got up above 50% requirement, company people have figured it should be part of the standard car package. But that was on $2 and $5 and $10 merchandise—not $150 options. Liklihood: automatic transmission will continue to be an accessory, but it will be produced on so many cars that the standard transmission equipment will be the exception, not the rule.

Never before in history did automobile production reach the level it did during the second week of May. Output was estimated by Ward's Automotive Reports at 177,898 units, this total including both the United States and Canada. The big factor in the jump from earlier levels around 150,000, of course, was the return to production of Chrysler Corp. after its strike.

That problem ended, the auto industry had another one to wrestle with—the rail strike. Operations began to curl up along New York Central and Baltimore & Ohio shipping points late during the second week of May. Cleveland and Detroit particularly were hard pressed by tie-ups of switching service as well as incoming and outgoing freight.

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Optimistic straws in the automobile production wind: in spite of near record production by many manufacturers during April, no less than eight separate producers saw more cars sold at retail than they were able to build during the month. Chevrolet's deliveries were 2,333 over its production of 125,052. Ford sold nearly 3,000 over its production. Buick sales were 6,837 above its output of 46,533. Oldsmobile, Mercury, Nash, Hudson, and Packard also had the pleasure of watching their April delivery figures surpass their April manufacturing figures.

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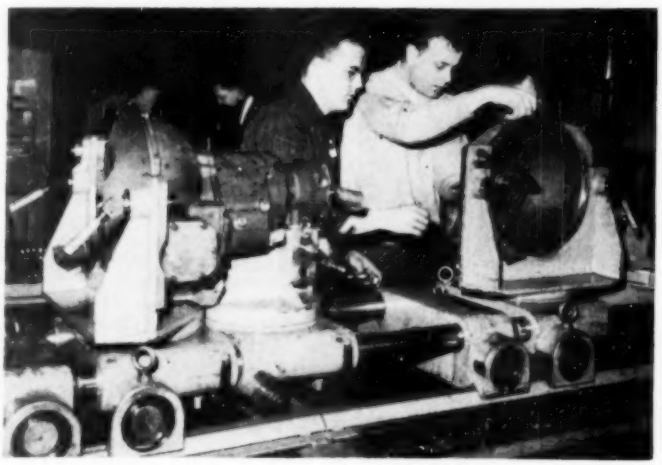
Latest word on the noise and room problems in power steering developments for automobiles: the noise problem can be overcome in time, but provision for room enough to install booster mechanisms for steering will probably have to await long-term redesigns in passenger car front ends.



ASSEMBLY LINE FIXTURES *at Chevrolet-Cleveland transmission plant are precision affairs. They have to be because assembly jobs are first worked on from the side of the line, after which front pump and converted housing segments of transmission assembly are indexed at right angles so they face each other and can be fitted together—and in a fairly precise fit. At left is seen completely assembled housing; at right workers are doing some of last operations on housing before it is swung counter-clockwise at right angles to receive remainder of assembly, out of sight farther to right.*

New Tooling

Machine tool orders are being sustained close to 100 on the index of National Machine Tool Builders' Association. Export sales are down somewhat. But domestic demand offsets this loss.

There is reason to believe that bookings will hold at high levels the rest of the year. Seasonal dip in midsummer is expected, as plants shut down for vacations. But the decline should be mild, with resumption of heavy buying in early fall.

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Automotive industry continues its role as chief machine tool customer. Chevrolet is in spotlight with huge new requirements for transmission manufacture (see Detroit, p. 122).

Ford has placed some orders for Cleveland engine factory, but millions of dollars of new machine tools are yet to be bought, probably in next 90 days. Electric motor, heavy electric equipment and household appliance manufacturers are in market for new machines.

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Reason: competition is keen, with no holds barred, and cost saving is imperative. Materials and labor rates are up, but prices of finished goods must stay down.

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Important trend: larger percentage of inquiries are being converted into sales. Ratio now is 40-60%, formerly was 10-30%. Pick-up in sales of standard machine tools is most encouraging point of all.

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Motor car makers are hammering for quick deliveries. Considerable special-machinery business has been lost to favored builders by inability to meet delivery dates specified by Detroit customers. Benefit of this policy is that it helps spread work among more builders.

Aside from automotive people, buyers are not pressing hard for deliveries. Dealers say they are watching credit more closely than at any time since war.

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April orders for machine tools dropped slightly from the March peak. Sag in ECA-financed buying was responsible. Shipments during April fell off sharply, both domestic and foreign.

Unfilled orders rose steeply in April because shipments were so far behind volume of new orders. At April production rate, machine tool builders have on hand orders equal to 6½ times shipping rate.

Very good explanation for poor shipping figure is pile-up of orders for special machine tools in limited number of shops. Shipments will be much higher later on as orders placed early in year are completed and machines delivered.

• • •

Cutting tool manufacturers report business running well ahead of same period last year. In April and May of 1949, bookings dropped precipitately. This year, sales in these two months have increased over first quarter's average.

• • •

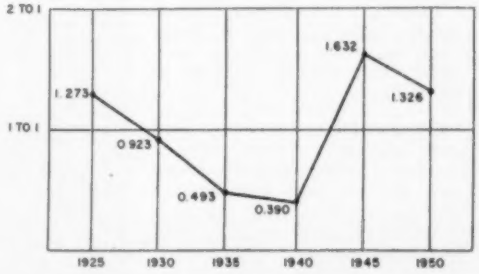
What is more, outlook for third quarter is very bright. Customers are purchasing cutting tools in line with current usage. A year ago, by contrast, they were bent chiefly on trimming inventories drastically.

• • •

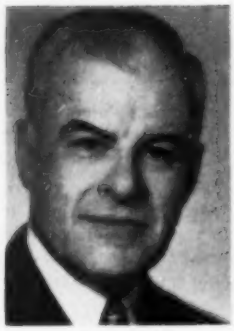
There is no letdown in orders for mechanical and hydraulic presses. Automotive buyers still are providing biggest chunk of business. Most urgent problem facing press builders is to try to meet early delivery dates requested by Detroit customers.

• • •

Tool and die shops are doing better. Retooling programs are providing work for many shops which have been on slack schedules.



***CURRENT (EQUIPMENT) RATIO** chart developed by L. W. Scott Alter, president and general manager, American Tool Works Co., shows in financial terms the condition of a plant's well-being. Ratio results from dividing all machines less than 10-years old (assets) by all machines more than 10-years old (liabilities). In 1925, for instance, ratio was 1.27 to 1, or 127 machines less than 10-years old for every 100 machines which were older. An upward movement of the curve is favorable. Chart is based on figures reported by six successive American Machinist inventories.*



Roy C. Ingersoll

James C. Zeder

Norm J. Kirk

Robert Potter

Names in the News

Roy C. Ingersoll, previously vice president of Borg-Warner Corp., Chicago, was elected president to succeed **C. S. Davis,** who was elected chairman. **G. A. Shallberg,** previously executive vice president, was named chairman of the executive committee. Mr. Ingersoll, in addition to his duties as president, will assume duties formerly assigned to the office of executive vice president. **A. P. Emmert,** president, Warner Gear Div., was elected vice president of Borg-Warner, remaining also as head of Warner Gear. Mr. Davis, one of the founders of Borg-Warner Corp. in 1928, served as chairman during the first year and has been president ever since. Mr. Ingersoll has been serving also as president of Ingersoll, Franklin & Calumet steel divisions of Borg-Warner. **Ray P. Johnson,** a Borg-Warner director and first vice president of Morse Chain Co., a B-W division, has been named administrative assistant to Mr. Ingersoll.

Lawrence J. Kline has been named sales manager, Automatic Div., Automatic Transportation Co., Chicago, after 30 years with Mercury Mfg. Co., Chicago, where he has been executive vice president since 1947. He is a past president of the Electric Industrial Truck Assn., the Caster & Floor Truck Assn., and the Materials Handling Institute.

A. J. Edgar, general manager, Hunt-Spiller Mfg. Corp., Boston, has been elected a vice president.

Thomas A. Hammer, Jr. and **Irving R. Warshow** have been named assistant treasurer and assistant controller, respectively, of Doehler-Jarvis Corp., New York.

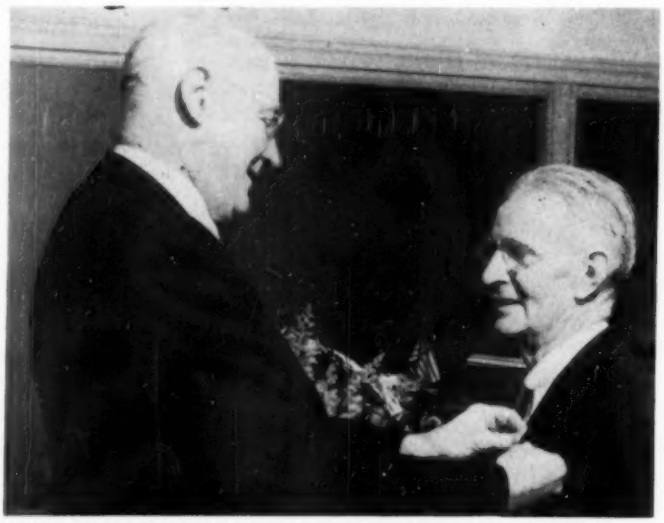
James C. Zeder has been named director of engineering and research, Chrysler Corp., Detroit. He has been with Chrysler since the firm was organized in 1925. Just prior to his present promotion he was chairman of the engineering board of the Engineering Division. He has been president of Chrysler Institute of Engineering since Jan., 1947. During the war he served as chairman of the SAE War Engineering Board. He is now national president of SAE.

Arthur H. Nolde has been named operating superintendent of Falk Corp. machine shops, Milwaukee. Last year he was chairman of the Standards Committee of ASTE.

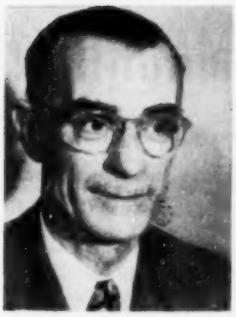
Norm J. Kirk and **Robert Potter** have been elected vice presidents of E. W. Bliss Co., Toledo. Mr. Kirk is manager of the Toledo division where heavy forming presses are made. Mr. Potter is manager of the company's Rolling Mill Division at Salem, Ohio.

Sam Tour, chairman of the board of Sam Tour & Co., Inc., New York, has been elected chairman of the Inter Society Corrosion Committee of the National Assn. of Corrosion Engineers.

W. Earle Shumway has been named manager, sales engineering dept., Abrasive Div. of Norton Co., Worcester, Mass. **Fred L. Curtis** has been named sales manager, western region.



40-YEAR SERVICE PIN is bestowed upon Frank O. Hoagland, Pratt & Whitney master mechanic, by Frederic U. Conard, president and general manager of Niles-Bement-Pond Co. Also feted at a special anniversary ceremony was Hubert D. Tanner, vice president and director, a 30-year P & W man



Harry J. Roberts

James L. Myers

Robert S. Cave

Robert C. Blackinton

Harry J. Roberts has been named to the newly created position of factory works manager, Cory Corp., Chicago. He has been with Cory since 1946 as chief industrial engineer in charge of plant layout and methods. Previously he served as staff engineer with Automatic Electric Co.

Richard H. Olson, formerly vice president in charge of sales, has been elected president of Electric Machinery Mfg. Co., Minneapolis, wholly-owned subsidiary of Worthington Pump & Machinery Corp. He succeeds **Walther H. Feldmann,** who has resigned to become vice president in charge of sales of Worthington.

William R. Loughran has been named general purchasing agent, Ford International, New York. Since October, 1949, he has been manager of the Government Purchases Section.

James L. Myers has been re-elected president of Associated Industries of Cleveland. He is president of Cleveland Graphite Bronze Co. **A. E. Gibson,** president of Wellman Engineering Co., has been re-elected vice president of Associated Industries, and **Claude E. Murray,** executive vice president of Willard Storage Battery Co., was re-elected treasurer.

L. C. Fuller and **Howard F. George** have been elected vice presidents of Browning-Ferris Machinery Co., Houston. Mr. Fuller was also appointed manager of the Dallas plant, succeeding **H. L. Burleson,** retired. Mr. George continues as sales manager.

John Neuman has been named plant manager, Midland Die & Engraving Co., Chicago. Before joining Midland he owned and operated Newark Plastic Molds, Newark, Ohio.

Robert S. Cave has been named general sales manager, Severance Tool Industries, Inc., Saginaw, Mich. He joined Severance in 1940 as a machine operator. Previously he was with Bay City Div. of Electric Auto-Lite.

Robert C. Blackinton has been named plant manager, Pioneer Engineering & Mfg. Co., Detroit. Most recently he was vice president in charge of manufacturing for Federal Telephone & Radio Corp., Clifton, N. J. From 1942 to 1946 he was manager of the Special Ordnance Div., Blaw-Knox Co., York, Pa. Previously he was with Cadillac and Pontiac Motor Divisions of General Motors Corp.

Hamilton Merrill, vice president and director of Manning, Maxwell & Moore, Inc., Bridgeport, Conn., has been named vice president in charge of the Consolidated-Ashcroft-Hancock Div.

Obituaries

Ambrose Bowyer, 73, for many years western manager of AMERICAN MACHINIST, died in Los Angeles on May 3. In 1921 he founded *Motor Service Magazine.*

Walter G. Robbins, president, Carboloy Co., Inc., Detroit, died of a heart attack May 18 at a conference in the General Electric Co.'s Knolls Research Laboratory, Schenectady.

Guy S. Hyatt, 46, comptroller of General Electric Co.'s Apparatus Dept., Schenectady, died April 30. He joined GE in 1923. He was elected assistant comptroller in 1942, in 1945 was named assistant comptroller in charge of Apparatus Dept. accounting, and the following year was named comptroller.

George A. Yost, 71, president of Lucas Machine Tool Co. from 1942-49, died April 19. He retired last year following sale of the company to New Britain Machine Co. He joined Lucas in 1902 as secretary. He was a member of NMTBA.

Fay H. Willey, 53, founder and president of Willey's Carbide Tool Co., Detroit, died May 6. He was one of the pioneers in development of the tungsten carbide industry and was also well known in the industrial diamond business.

Guy S. Hyatt

George A. Yost

Fay H. Willey

WHEN SHOULD YOU REPLACE A MACHINE?

Practical application of MAPI formula pays off, author proves, in explaining step-by-step the simple calculations you can use in determining when to purchase new equipment

By EVERETT M. HICKS
Assistant Manager
Grinding Machine Division
THE NORTON COMPANY

THE MAIN problem of equipment policy is when to replace. It is usually not too difficult to decide what kind of equipment to buy. The main question is, "When does it pay to replace a machine with a new one which will do the job better?"

Errors in timing can be very expensive. If the method for testing replacements is prejudiced unnecessarily against purchase of new equipment (and this is usually true of methods in use today), purchase of new equipment may be deferred many years beyond the time when it should properly be acquired. As a result, we will continue to incur unnecessarily high costs while we wait for operating costs to go high enough to pass the test. Conversely, it is possible to replace equipment too soon and thus incur avoidable costs.

The decision to buy new capital equipment is a long-range commitment. To time these purchases properly, we must make reasonable estimates and assumptions regarding the future, particularly for the machine which we propose to purchase.

Based on paper presented at NMTBA spring meeting in Chicago, May 5.

All machinery is subject to wear and tear and usually to obsolescence as the years pass. This will be equally true of the new machine if we buy it. A gap will open between operating performance of the machine in service and performance which can be obtained from the best current alternative machine. This gap may be due to the wearing out of the machine with use or to expected improvement in design of future machines. This difference in operating performance between the machine we own and the best one we can buy is called *operating inferiority*.

In replacement analysis we are faced with a choice: if we retain the old machine, we keep down our capital cost and accept higher operating cost; and if we replace, we obtain mechanical perfection for the moment but at the expense of an increase in our capital cost.

Key to Correct Policy

Here is the key to correct equipment policy. To reach a correct decision when considering new machines, we must compare the sum of operating inferiority and capital cost for present equipment with that of the proposed equipment. The decision will be in favor of that equipment which gives the smaller total of inferiority and capital cost.

The purpose of the MAPI formula is to enable us to find and compare these totals of inferiority and capital cost for both present and proposed machines. For ease of reference these totals have been given a name, *adverse minimum*. We should replace when the average of future inferiority and capital cost obtainable from the new machine is below that obtainable from further use of the old one. In other words, the proposition with the lowest adverse minimum wins.

In the case of present equipment, the adverse minimum is obtained first by calculating savings to be expected next year if the new machine is installed. This is the operating inferiority of present equipment compared with the new. To this is added the capital cost of retaining the old equipment. The total is the adverse minimum itself. Let's see how this is done.

EXHIBIT "A" — Grinder Replacement

Three diameters on a drive pinion are being ground as separate operations on a battery of cylindrical grinders. The machine tool salesman recommends the use of a larger grinder mounting three wheels which will grind all three diameters simultaneously. The estimated production time is about 50% less by this method, so the proposal is calculated on the basis of replacing two present machines with one larger machine costing $16,000 installed.

The present machines are 10 years old and can be sold for $1500 each, or a total of $3000 for two. It is estimated that the new machine will have a profitable service life of 10 years, at the end of which time it can be sold for $2500.

Direct labor savings are figured on a full one-shift basis as $3,328 (40 x 52 x $1.60). In addition it is expected that there will be savings of $200 on inspection and $100 on supervision, so $300 is entered for indirect labor. Fringe benefits such as paid vacations and holidays, pensions, group insurance, etc. amount to 20% of the payroll in this plant, giving an annual saving of $725.

Since there will be one new machine to maintain in place of two older ones, maintenance savings are conservatively estimated at $200. There is also a reduction in badly needed floor space of 100 sq. ft. and less power will be used, these items creating a cost reduction of $50 each.

Property taxes and insurance amount to 5% of the book value of equipment, which will amount to $500 higher cost because of the increased value of the new machine.

First let us find the adverse minimum of the proposed equipment. Obviously, the new equipment, if installed, will gradually accumulate inferiority in the years ahead as it deteriorates in service and as new and improved machines become available. While we cannot foresee the exact amount of this inferiority year by year, the MAPI formula assumes that it will occur at a constant rate which will make it replaceable by some other new machine at the end of its estimated service life.

Thanks to this simplifying assumption, it is possible to develop a chart which permits figuring the adverse minimum of the proposed equipment directly. All that is required is to estimate the service life and the salvage value, if any, at the end of that service life. With this information the calculation of the adverse minimum requires only a moment.

Step-by-Step Calculations

Suppose we go through step-by-step the calculations necessary to arrive at the answer in a typical replacement analysis. Exhibit "A" (page 126) gives all the essential facts in the case. Exhibit "B" shows this case worked out on the Equipment Replacement Analysis form developed by The Norton Company. Information on Lines 1 to 5 is entered from data on Exhibit "A." Lines 6 through 12 show calculation of adverse minimums for present and proposed equipment respectively. Line 12 is for the Gain from Replacement for the first year. Before discussing this section, however, we must calculate the operating advantage of the proposed equipment next year (Lines 13 through 29).

Note that the part of the form for estimating operating advantage is essentially the same as forms generally used to calculate savings from equipment. All items commonly affected by purchases of new machines are listed as a checklist to be sure that no significant advantages are overlooked. If an advantage can be claimed for the new machine, it is better to assign it a reasonable dollar value so that it will have its proper influence in the replacement decision.

EXHIBIT "B"

NORTON COMPANY
EQUIPMENT REPLACEMENT ANALYSIS

Est. No. ____
Date 5/8/50

Line No.		PRESENT		PROPOSED
1	Description 2 - 6 x 18" Grinders (with single wheels)		Description 1 - 10 x 18" Grinder (with 3 grinding wheels)	
2	Salvage value	$ 3,000	Cost installed	$ 16,000
3	Age	10 yrs.	Service life	10 yrs.
4	Equipment Number		Estimated salvage value	2,500
5	Department		Salvage ratio	17%
	ADVERSE MINIMUMS			
6	Operating inferiority (line 29)	$ 4,153	Total cost installed	$ 16,000
7	Loss salvage value - next year	300	Chart %	11.44
8	Interest - salvage value	300	Interest %	10.0%
9	Proration - capital addition	--	Total %	21.44
10	Interest - capital addition	--		
11	ADVERSE MINIMUM	$ 4,753 (A)	ADVERSE MINIMUM	$ 3,430 (B)
12	GAIN FROM REPLACEMENT (next year) (A - B)	$1,323		

OPERATING ADVANTAGE (next year)

		PRESENT	PROPOSED
	INCOME ADVANTAGES		
13	Superiority of product	$	$ --
14	Increased output		--
15	Other		--
	COST ADVANTAGES		
16	Direct labor (52 x 40 x $1.60)		3,328
17	Indirect labor (inspection & supervision)		300
18	Fringe benefit costs (20%)		725
19	Maintenance		200
20	Supplies		---
21	Tools		---
22	Spoilage		---
23	Down time		---
24	Floor space (100 x $.50)		50
25	Power		50
26	Property taxes and insurance	500	---
27	Other		---
28		$ 500 (C)	$ 4,653 (D)
29	NET OPERATING ADVANTAGE (D - C)		$ 4,153 (to line 6)

Remarks:

Recommendation:

Signed _____ Approved _____
Date _____ Date _____

Under present practices a great many replacement analyses are decided solely on direct labor saving involved. While it usually is the most important single factor, there are many cases where other benefits may swing the balance in favor of replacement.

Income advantages are listed because frequently the choice of equipment will affect the income of the company as well as its cost. A dollar of added revenue is just as good as a dollar of reduced cost.

In our case example, replacement of two machines by a single machine saves one direct labor operator. That amounts to $3328 next year and is entered on Line 16. Indirect labor savings of $200 on inspection and $100 on supervision give a total for Line 17 of $300.

Cost of fringe benefits is becoming increasingly important with advent of pension plans and group insurance, yet it is often overlooked. It is easy to determine the percentage of these costs to the payroll, and add it as a percentage of the amounts shown for both direct and indirect labor savings. Entering figures for reduced cost of maintenance, floor space and power, we have a total on Line 28 of $4653 of savings for the proposed machine.

Saving from reduced floor space is debatable. If the space freed is not immediately usable for other purposes, no credit should be given to the proposed equipment. On the other hand, if the space is needed and usable, proper credit should be given for this item. The entry of $500 on Line 26 in favor of the present machine for property taxes and insurance is proper because these items will increase if there is an addition to the investment, which is subject to taxation and insurance.

Subtracting $500 advantage for the present from $4653 for the proposed on Line 28 gives a net operating advantage of $4153, which is entered on Line 29. This figure is the net operating advantage of the proposed equipment as compared with the present equipment for next year only. This amount is transferred to Line 6.

Calculate Capital Cost

We are ready now to calculate the adverse minimum of the present machines (sum of operating inferiority and capital cost). The net operating advantage of the new machine is the same thing as the operating inferiority of the present machines. It remains now to calculate the capital cost of retaining the present machines to obtain their adverse minimum.

As stated on Line 2, the salvage value of present machines is $1500 each, or $3000 for the two. The capital cost for next year, if we keep these machines, is the interest on the present salvage value plus the amount by which we expect this salvage value will be reduced if we retain these machines one more year. From our knowledge of the secondhand market, we expect that a year from now these machines can be sold for $150 less for each machine than present value. So we enter $300 on Line 7 to cover loss of salvage value for the two machines.

If we keep the present machines, we will pass up $3000 in cash which we could get if we sell them now. It is reasonable then to charge interest on this $3000 as part of capital cost if we decide not to replace. For purposes of this illustration we are using an interest rate of 10%. We thus enter $300 on Line 8 for interest. Adding the three figures on Lines 6, 7 and 8, we arrive at a total of $4753 as the adverse minimum for the present machines as compared with the proposed replacement machine being considered.

Calculations thus far are almost the same as under any method used for replacement studies, because the biggest part of the job is to calculate the savings for next year under any method.

Lines 9 and 10 are included on the form for completeness. These lines are used only when a major expenditure is required to keep the present machines in service. Since this capital addition may extend the life of the machine for more than one year, it is improper to charge it in full against next year alone. This is handled by dividing the amount of the expenditure by the number of years of extended life to obtain the amount chargeable against next year.

For example, if a major overhaul costing $2000 is needed and the extended life is expected to be four years, $500 would be entered on Line 9. Since this $2000 expenditure must be made now, and in cash, interest on the full $2000 is charged on Line 10 (which, at a rate of 10%, would amount to $200).

Adverse Minimum Figured

We are now ready to calculate the adverse minimum of the proposed equipment. On Line 2 the installed cost of the proposed machine is shown as $16,000. This figure is based on the supplier's quotation plus an estimate of delivery and installation costs. We estimate the new machine to have a service life of ten years. This means the length of time we expect the machine will continue on the job before a new machine will replace it.

This service life is not the physical life of the machine, which may be much longer, nor has it any necessary relation to the life used for tax depreciation. After the machine has been replaced, it may survive in other service, or be sold and continued in use under other ownership.

The chart from the MAPI Replacement Manual which we are about to use for determining the adverse minimum of the proposed machine assumes that the proposed machine will acquire inferiority through future deterioration and obsolescence at a rate which will make it replaceable at the end of its estimated service life.

The first step is to determine the salvage ratio (shown on Line 5). This is calculated by dividing the estimated salvage value of the proposed machine at the end of its service life by its installed cost—in this case $2500 divided by $16,000, or 17%. We now have all the information to use the MAPI chart shown as Exhibit "C." Note that the vertical axis is in terms of percentage, and the horizontal axis of service life.

MAPI Chart — Exhibit "C"

The black curved lines on the chart are the salvage ratios. The curved lines show various values for salvage ratios from 0 to 50%. Running along the bottom of the chart horizontally to the service life of ten years, we then ascend this vertical line to a point representing our terminal salvage ratio of 17%. This point lies between the curved lines for 10 and 20%. We then read the point opposite on the vertical scale at the left (11.4%). This we enter on Line 7. The interest rate of 10% is entered on Line 8, giving a total of 21.4%. Applying this 21.4% to the installed cost of $16,000, gives the adverse minimum for the proposed machine of $3424, which is entered at the right on Line 11.

We now have a direct comparison of the adverse minimum for the present and proposed equipment. Subtracting the adverse minimum of $3424 for the proposed equipment from the $4753 for the present equipment, we enter the difference of $1329 on Line 12 which is labeled "Gain from Replacement —Next Year." Remember that this gain from replacement is after all capital cost has been charged against each of the two machines. In this case, the advantage of the proposed equipment is clear and the decision is to purchase.

Amount of Gain Required

How much of a gain is required to justify purchase of the new equipment? Since it can be expected that the operating inferiority of the present machine will continue to increase with the passage of time faster than its capital cost will decrease, it is almost certain that the adverse minimum for the present machine is as low now as it ever will be and that

it will continue to increase. Therefore, if the adverse minimum of the present and proposed equipment should prove to be equal in size, replacement probably is indicated.

One word of caution should be injected. The conclusions derived by this formula and by all other formulas are based on estimates. If the results obtained do not show a distinct advantage in one direction or the other, it is advisable to review the estimates to be sure they are reasonable. Nothing is gained by loading the estimates either for or against the proposed replacement. The formula is calculated to produce a fair result with no bias in either direction. Anyone who loads his estimates is only stacking the cards against himself.

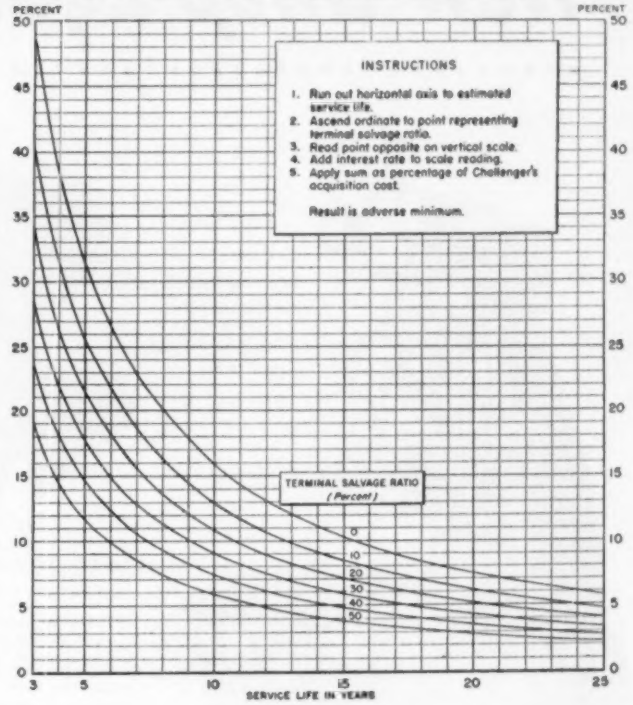
Some Major Advantages

Some of the more important advantages of the MAPI formula are:

(1) It gives a definite answer to the problem of when to replace. When the adverse minimum of the proposed equipment is less than that of the present equipment, purchase of the new equipment is definitely indicated. This overcomes one of the major disadvantages of methods popularly used, which either calculate the number of years required to pay for the machine out of savings, or calculate the percentage rate of return on the investment derived from savings. After it has been found that the new equipment will pay for itself in 3 years or will return 33-1/3% on the investment, it still remains a matter of judgment as to whether the replacement should be made. We all know from practical experience that the pay-off periods or rates of return required by various companies vary widely and usually prejudice the decision against replacement.

(2) A measure of the cost of not replacing is provided. The solution yields a dollar figure which, in our example, is shown on Line 12 as the gain from replacement for next year. This same amount is the loss from keeping the old equipment in service for one more year if it is decided not to purchase. We should keep in mind that this cost of not replacing is after reckoning in all of the capital and other charges that are applicable to the new equipment.

EXHIBIT "C"—Chart for deriving challenger's adverse minimum by the MAPI formula



(3) It furnishes an extremely useful tool for budgeting equipment expenditures because the formula furnishes the cost of not replacing. If the company cannot afford to purchase all of the new machinery economically replaceable, it is possible to put a price tag on each item in the form of what it will cost the company not to replace it for another year. The various projects can then be arranged in order of relative urgency and the company can select those projects which offer the greatest advantage per dollar of capital required. With this kind of information an equipment budget that means something can be created even when funds are limited.

(4) The MAPI formula was developed by a sizable group of capital goods manufacturers, who are likely to use and promote it. This should help in the task of obtaining user acceptance.

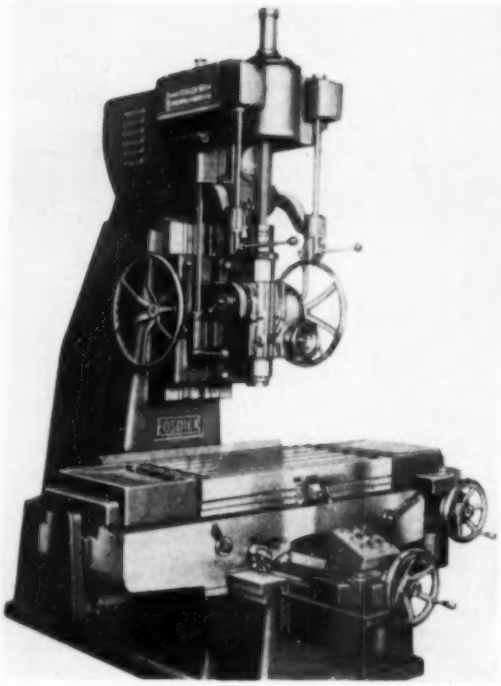
(5) The MAPI formula has built into it full allowance for future deterioration and obsolescence which can be expected on the new machine. This is rarely considered in most other methods used today.

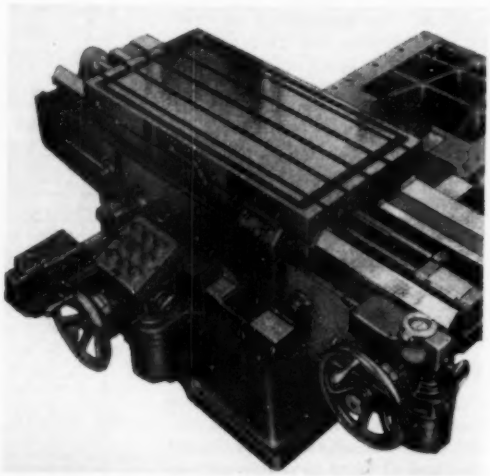
(6) Provision is made to recognize revenue as well as cost differences which result from acquisition of new equipment.

(7) The MAPI formula has its foundation on a firm basis of theory which has been spelled out in complete detail in the book on Dynamic Equipment Policy. The assumptions on which the formula rests are known and clearly stated. The MAPI Replacement Manual is a considerable simplification and can be mastered by those dealing with equipment problems.

(8) Actual mechanics of the calculations are not difficult, thanks to the short-cuts which have been developed, particularly the graphical solution to the problem of finding the adverse minimum of the proposed equipment.

New Shop Equipment





AUTOMATIC TABLE POSITIONING is controlled by duplicating bar in trough in front of indicator. Table positions to a hole in the bar. Bars are produced in 3 to 4 min per hole and installed on the jig borer in about 1 min. Table is rapid traversed to within 1/16 in. of final position. Automatic slide positioning works from a second duplicating bar in the same manner

Fosdick Jig Borer Positions Automatically

Time required to obtain setting of the table on a jig borer has been reduced by the automatic positioning incorporated in the No. 42P jig borer developed by Fosdick Machine Tool Co.

Rapid traverse to both table and slide is automatically engaged when using the positioning device. This eliminates the necessity of first rapid traversing and then operating the positioning pushbutton. Both table and slide can be automatically positioned at the same time, cutting this time approximately in half.

A separate micrometer adjusting block is placed on the table and slide which can be used to locate the center of the starting hole. This eliminates cut-and-try operations usually performed.

The machine is designed to drill, ream, bore, and tap. Spindle is guaranteed not to exceed 0.0002-in. run out at the end of a 12-in. proving bar. Table working surface is 18x42 in. The jig borer is said to be able to do any class of work within the range of the machine.

There are 24 speeds ranging from 30 to 1500 or any multiple thereof. There is a choice of three ranges of feeds available. Standard motor is 3 hp, but a 5- or 7½-hp motor can be supplied. The gearbox has a Twin Disc clutch to drive the spindle, and a second clutch to act as a brake.

There are two motors for rapid traverse of table and slide, and two motors for final positioning. A 9- or 12-station panel controls these motors, the spindle drive, and the cutting-lubricant-system motor.

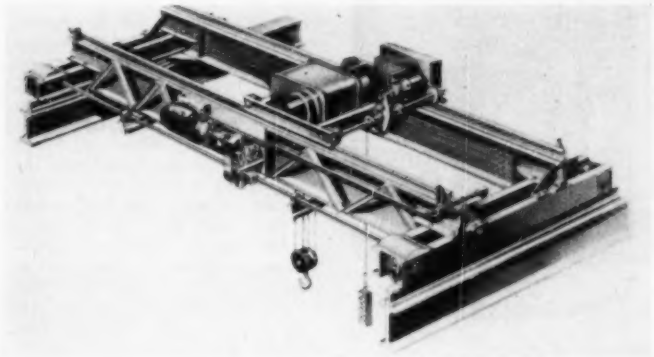
To rapid traverse the table away from the indicator, the operator pushes the button marked "Left." Either measuring rods or a duplicating bar can be placed in the trough in front of the indicator and the positioning button is pushed. The table rapid traverses to within 1/16 in. of position when a precision switch breaks the circuit on the rapid-traverse motor and energizes the positioning motor. After the table is positioned, the motor will reverse, taking out the backlash in the nut.

This device will position table and slide within ± 0.0001 in. A magnetic disconnect switch will shut off the entire positioning circuit if any part of the electrical positioning control fails.

Distance from table to spindle is 27 in., and spindle travel is 9 in. Head travel is 12 in. Table travel is 42 in. and cross travel 18 in.

Fosdick Machine Tool Co., Blue Rock and Apple St., Cincinnati 23, Ohio

Materials and Parts



12-Ton Traveling Crane Operates From Pendant Station

The use of stock parts and quantity-built components allows a lower initial cost on E-type cranes, designed for intermittent duty, overhead traveling work.

Capacities range up to 12 tons and spans from 20 to 60 ft. A pendant push-button control station may be operated from the floor if desired. The bridge or trolley may be supplied with a cab control. Fluid drive and magnet control permit fast and positive action. Head-room requirements are reduced over other models. The new line is intended primarily to reduce materials handling-costs.

Whiting Corporation, Harvey, Ill.

Abrasive Kit Has Six Diamond Combinations

For experimental and development work, this kit contains six most widely used Bureau-of-Standard grades of Dymo diamond compound.

Precision graded particles of pure diamond are permanently suspended in a synthetic vehicle to assure maximum cutting action. The six abrasive materials can be utilized in developing new finishing techniques, precision lapping, plastic-mold polishing, tool sharpening, and in die finishing.

Jars are nested in a wood case with a hinged lid. The material as delivered is ready for immediate application.

Industrial Products Div., Elgin National Watch Co., Elgin, Ill.

Primer for Light Metals Applied Without Pretreatment

Unichrome Primer AP-10 is said to provide excellent adhesion on magnesium and aluminum without chemical or electrochemical pretool sharpening, and in die finishing. treatment. An air-dried film of AP-10 becomes dust free in 5 min.

Developed by Princeton Paint Laboratories, the primer is applied by spraying or dipping. It can be air dried or baked. Other metals on which it can be applied are stainless steel, monel, tin, steel, brass, copper, and galvanized metal.

United Chromium, Inc., 51 East 42nd St., New York 17, N. Y.

... INCLUDING

Fluid tracer, when applied to standard lathes, serves the dual purpose of tracing from a master and handling regular lathe work. It does not limit the lathe capacity .....Page 132

Bending press of 300-ton capacity blanks out clutch rings and gear teeth at 25 strokes per min .....page 134

End mill, available in stock sizes from 1½ in. up, is said to reduce milling tooling costs as much as 25 percent.....page 136

Portable tester identifies metals and alloys through surface films by electrolytic means...page 138

Hydraulic surface grinder provides 12-in. crosstravel and 18-in. table length.....page 140

Tool and cutter grinder requires only 6-oz. pressure on operating lever to start movement.....page 144

Automatic center punch permits visual variation in spring pressure from 5 to 35 lb.....page 146

Salt-bath furnaces are equipped with submerged electrodes. Units are intended for deep baths ranging from 1700 to 2400 F..page 148

...and in June 12

Pantograph for rapid hole location, and a turret for quick access to punches and dies are combined in one high-speed press.

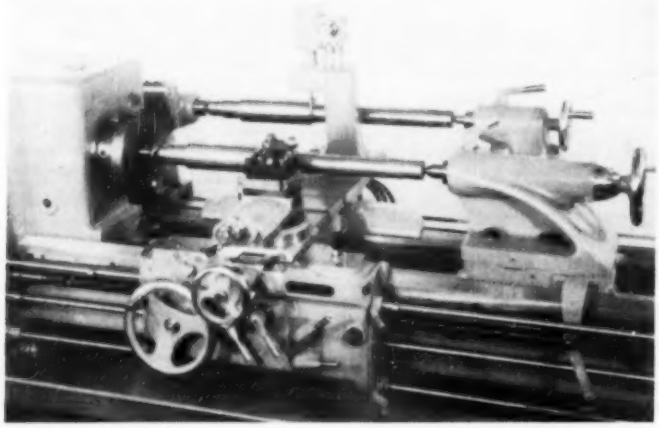
Universal chuck for lathes, indexing heads, and circular tables of milling machines, clamps concentric and is excentrically adjustable.

Machine Control Unit Developed To Reduce Indirect Labor Costs

Basic components of the Cross Machine Control Unit are a master control board, a master toolsetting fixture, a work bench, and Cross Toolometers which automatically shut down the machine when tools need changing. The control board is divided into sections for each type of tool in the machine. Every section comprises a toolsetting gage, a tag with the perishable tool and holder numbers, storage space for two complete sets of tools and holders, and a Toolometer. Alphabetical letters on the board and corresponding ones on the machine heads further group the tools and guide the operator. Colored areas on the control board point out the location of the machine head.

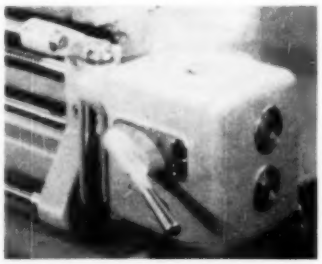
The Toolometers provide visual records of used and unused life of every type of tool in the machine. When any one of the Toolometer pointers reaches zero, the machine stops automatically. Red areas on the dials, adjacent to the zero mark, represent "danger zones" for the last two hours or any appropriate period of productive tool life. When one of the Toolometers stops the machine, all tools in the danger zone are replaced. The Toolometers are then reset by manually turning the pointers clockwise to positive stops which establish starting positions. The stops are adjustable to provide different settings for various types of tools and amounts of work. Time studies are reported to show that actual changing of a preset tool requires only two minutes compared to seven minutes for conventional tool change. Reduction of scrap and a decrease in tool-grinding time are also reported by use of the Machine Control Unit.

The Cross Co., Detroit, Michigan



Fluid Tracer Works From Master

Applied to standard lathes the Fluid Tracer serves the dual purpose of tracing from a master and handling regular lathe work. It does not limit the capacity of either, eliminating the necessity of having a single-purpose machine. Conversion from tracer control to regular lathe control is made by movement of one lever. Regular compound and crossfeed assemblies are used and are directly connected to a hydraulic cylinder mounted at the rear of the carriage in the same manner as the standard taper attachment bracket. They do not require a special fixed angle rest to reproduce a sharp right angle.



Conversion from tracer to regular lathe control is by lever on front of clutch and brake unit.

The compound rest can be swiveled to any desired angle for turning and boring, and both the topslide and crossfeed dial can be used for setting the tool to the desired depth of cut. If round templets are used, the master piece can be machined in the regular manner and then used as a templet. Longitudinal adjustment to the master can be made by the auxiliary tailstock centers. The center on the auxiliary tailstock nearest the headstock is spring loaded.

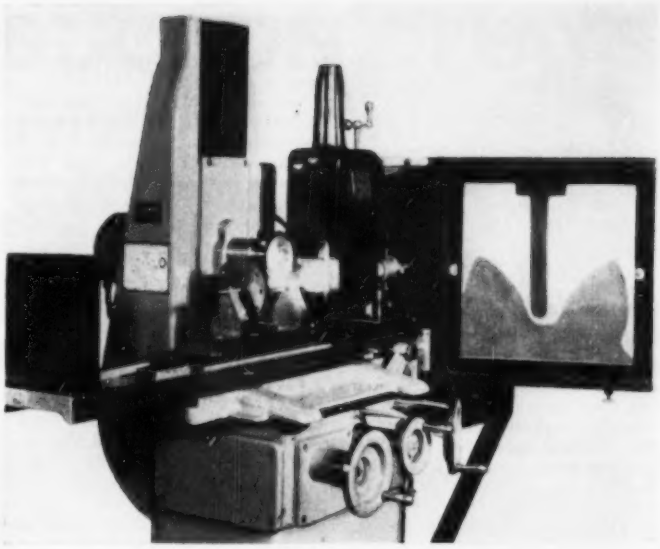
and reverse rapid traverse and feed to the cross-slide. Rate of crossfeed is controlled by the valve mounted on the front side of the tracer head and the direction of traverse by the lever on the front of the carriage. The tracer head controls the cross movement of the tool as well as the hydraulically operated clutch-and-brake mechanism located at the tailstock end of the bed. The clutch-and-brake mechanism synchronizes the longitudinal movement of the carriage with the rate of cross-slide travel and also by-passes the flow of oil when the lathe is used for regular lathe work when the tracer is not in use.

The Sidney Machine Tool Co., Sidney, Ohio

Foot-Operated Hydraulic Vise Frees Both Hands for Work

Vise with two-pedal foot control leaves both hands free for every operation, the vise being closed, locked, and released by the operator's foot. A large pedal in the floor unit controls both the closing of the vise and the application of pressure. A smaller pedal is used for release. Maximum gripping pressure is about 6000 psi and a safety valve protects the tool from overloading. All precision parts of this self-contained unit are protected from shop dirt. It is a swivel vise with 3½-in. jaw width and 6-in. jaw opening.

The Columbian Vise & Mfg. Co., 9021 Bessemer Ave., Cleveland 4, Ohio



Contour Grinder Combines Image, Profile, and Templet Techniques

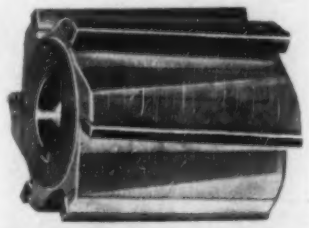
The Visual-Grind contour grinding machine provides three techniques in optical contour grinding; image, profile, and templet. The bounce-back feature makes possible "Reflecto-Image" grinding with the light descending from its source in the lamp house condensed onto an oblique reflector which directs the beam to the left against the front of the work. The image passes through precision lenses for magnification and is projected on the screen without inversion or reversal.

Profile projection is performed by placing an auxiliary mirror behind the work. Light shines on the work and grinding wheel and is reflected back through the aperature and lenses to the ground-glass screen. A profile of the work shows on a brightly illuminated screen.

The templet technique combines Reflecto-Image and profile projection. A polished precision templet of desired shape is fastened to the front of the work and photographs of both are projected on the screen simultaneously. Work can then be accurately ground to the desired form by matching its magnified image with that of the templet.

Matched lenses are said to afford finest definition, adjustment being easy and quick. The usual ground-glass viewing screen is recommended though bright line or other types common on comparators can be employed. Four standard magnifications are available and capacity is 6x16x8 in. high using 7-in. wheel.

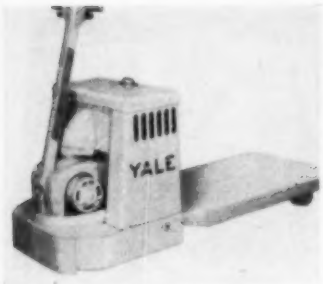
The Cleveland Grinding Machine Co., 6514 St. Clair Ave., Cleveland 3, Ohio



Carbide-Tipped Slab Mills Added to Nelco Cutter Line

Carbide-tipped slab mills are available in Nelco Series 300 for use on cast iron, brass, and bronze, and Series 400 for aluminum, magnesium, and similar metals. All tools are of spiral-tooth design and have such Nelco features as slash-milled carbide-tipped seats and nickel shim brazing. The company does not recommend these tools for steel-milling operations as yet. The tools are manufactured in a wide range of sizes.

The Nelco Tool Co. Inc., Manchester, Connecticut.



Materials-Handling Truck Shortened 6 Inches

A 6-in. saving on length has been effected between the battery box and front edge of the truck on the "Stubby" worksaver. The pallet-handling truck is operated by a walking operator who adjusts controls in the handle.

Weight capacities range from 4000 to 6000 lb., and platform lengths can be had in 36- to 72-in. sizes in 6-in. increments. Platforms are available in heights of 6, 7, 10, and 11 in., and in widths of 19, 24, and 26 in. for handling skids of different sizes.

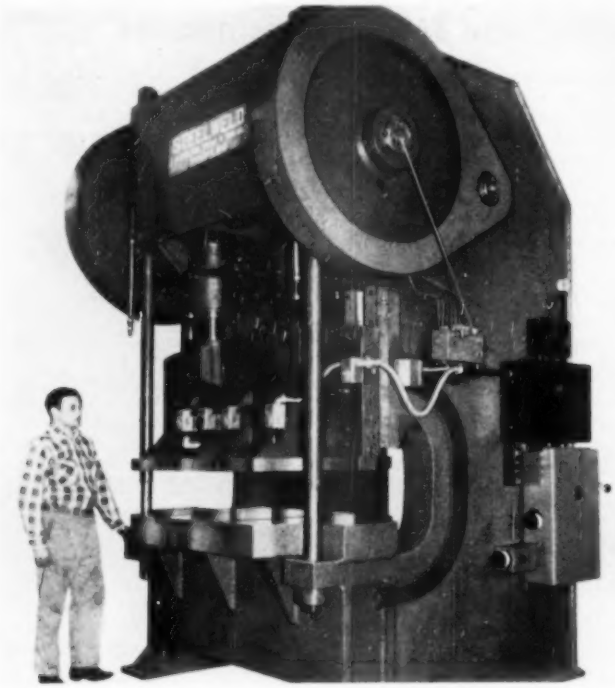
Two equalized hoist cylinders lift loads by oil pressure. Controlled flow regulation through a solenoid valve cushions descent of the load. The hydraulic system is protected against excessive pressures by an overload relief valve built into the solenoid unit.

The Yale & Towne Mfg. Co., Philadelphia, Pa.

Hard-Surface Enamel Dries in 15 Min

A fast-drying enamel, Base Y 2054, is said to provide the hardness of a baked-on synthetic with the fast drying of lacquer. Products finished with this synthetic may be handled and stacked within 15 min. and packed within 3 to 4 hours.

United Lacquer Mfg. Corp., 1001 W. Elizabeth Ave., Linden, N. J.



***BENDING PRESS,** 300-ton capacity, blanks out clutch rings and clutch-gear teeth at 25 strokes per min. Shut height is 14 in. and throat depth is 18 in. Bed is 3 x 4 ft. Tierods may be removed for extra space. Operated by two men, the press can be stopped by either. Each man must depress two sets of push-buttons to keep press running. Selector switch on clutch control allows long, short, continuous, or inching strokes — The Cleveland Crane and Engineering Co., Wickliffe, Ohio*

Shop Microscope Magnifies Threads and Finished Surfaces

Designed for checking close work under rough shop conditions, Model S-186 is a 20-power wide-field microscope. It is intended for checking castings, machine threads, surface finishes, welds, raw materials, and fibers.

The microscope may be used in any position and can be adjusted on its stand to check pieces up to 12 in. in height. The unit may be used in relatively low-illumination levels. Fine focus is obtained with a built-in helical focusing eyepiece. The stand, mounted on an extra-heavy base, is portable and may be moved to the job.

Buhl Optical Co., 1009 Beach Ave., Pittsburgh 12, Pa.

Thread-Cutting File Handles Assemble on Any Tang

Reusable file handles which fit any tool with a tang cut their own threads with tapped metal inserts. Protection against splintering is provided by die-cast Lauber-metal ferrule that covers the entire end of the hardwood handle. Similar soldering-iron handles are also available.

Lauber Handle Mfg. Co., 3240-42 West National Ave., Milwaukee 4, Wis.

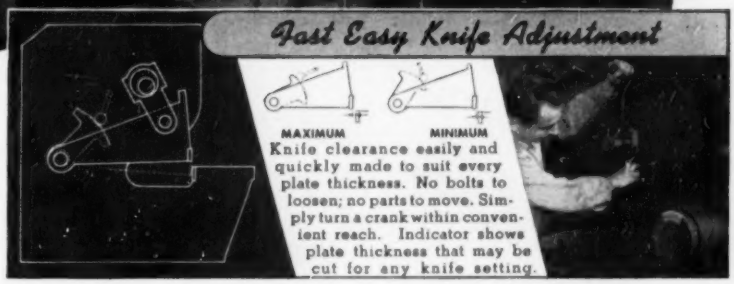
NO PRODUCTION DELAYS

when changing knife clearance on

STEELWELD SHEARS

CUTS 3/4"x10'-0"

This machine cuts plate to ¾" x 10'-0". Other Steelweld Shears available for shearing all thicknesses to 1½" and for lengths to 18'-0". Note the electric foot switch for operating shear — one of many Steelweld production-speeding features.


Fast Easy Knife Adjustment
MAXIMUM
MINIMUM
Knife clearance easily and quickly made to suit every plate thickness. No bolts to loosen; no parts to move. Simply turn a crank within convenient reach. Indicator shows plate thickness that may be cut for any knife setting.

Not hours, not minutes, but seconds — and only a few of them — is all it takes to change the knife clearance on Steelweld Shears.

Shear users, experienced with various makes, are always amazed at the speed, simplicity and accuracy of Steelweld's Micro-Set Knife Adjustment. This feature has strong appeal because they know the importance of having proper knife clearance for the thickness metal being worked on to secure the best possible cuts. They know, too, that with other shears it usually is a major operation to change knife clearance and for that reason is not always done.

Because knife adjustments are made so easily on Steelweld Shears, this becomes a natural step in the working routine of Steelweld operators. It is performed quickly, efficiently, without affecting production. There is no danger of accidental damage. And remember, PROPERLY SET KNIVES REMAIN SHARPER LONGER.

Steelweld Shears are modern heavy duty machines in a class by themselves with a host of features heretofore unavailable. Get the facts and check over the many advantages they offer you.

GET THIS BOOK!

CATALOG No. 2011 gives construction and engineering details. Profusely illustrated.

THE CLEVELAND CRANE & ENGINEERING CO.

1420 EAST 282nd ST. *WICKLIFFE, OHIO*

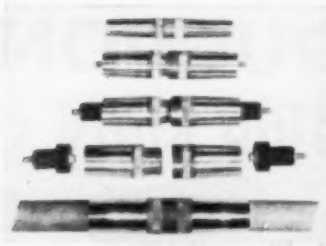
STEELWELD PIVOTED BLADE SHEARS

Sealable Pump Motor Has Pre-set Speed

Speed-Trol variable-speed motor may be set for operation at a positive setting or within any pre-determined range of speeds, then sealed. The sealing feature allows detection of any tampering.

The unit is recommended for driving pumps which work high-temperature fluids or for rotating agitators, mixers, blenders, grinders, or feeders. A white finish can be supplied if it is desired. Totally enclosed, splash-proof, or drip-proof models are available.

Sterling Electric Motors, Inc., Los Angeles, Calif.



Light Industrial Connector Joins Tubing, Rods, Poles

Lightweight connecting screw joint can be used for fastening rods, tubes, poles, and other stock. The joint is made of aluminum tubing with a machined thread and knurled exterior for tightening.

Sections are attached by drilling a hole in the end of the rod and inserting a step-down rubber expansion piece. When tightened, it expands, and is said to give a slip-proof fitting. The connectors are available in five sizes from ½ to ⅞ in. Other sizes and materials are available on special order.

Minit-Joint Co., 115 South Lafayette Blvd., South Bend 1, Ind.

Torch Goggles Have Welding-Helmet Features

Free-floating headgear used on welding helmets has been adapted to support shielded goggles. The equipment is intended for gas welders, cutters, burners, brazers, and furnace men.

A knob adjustment shifts the band to the wearer's headsize. All mechanisms are guarded by fiber for insulation and to prevent hair-pulling. The swiveling feature on welding masks has been carried over to the goggles, so they may be shifted up by a flick of the wrist.

American Optical Company, Southbridge, Massachusetts.

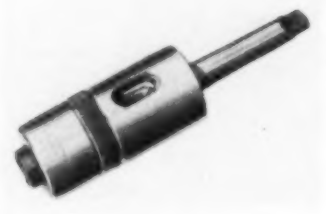
End Mill Locks in Boring-Mill Adapter

Available in stock sizes from 1½ in. up, Positiv-lok end mill is said to reduce milling tool costs as much as 25%.

The end mills are located in a special holder whose gripping power is aided by the torque of the mill in operation. This system eliminates the need for integral tapered-shank end mills on large boring-mill jobs, profiling, and similar heavy-duty applications.

Lightness and easier handle ability are claimed to reduce set-up time and change-over time.

Putnam Tool Co., 2981 Charlevoix Ave., Detroit 7, Mich.



Toolholder Floats to Correct Misalignment

The principle employed in the *JA* floating holder has been lifted from the power transmission field. Misalignment between two shafts can be compensated for by a double-gear or spline-drive coupling.

The holder will give unrestricted parallel or angular float for accurate tapping, reaming, and drilling. Float in all directions is assured by the drive coupling and two standard ball-thrust bearings. Because of its small diameter, the unit is recommended for close-center and multiple-spindle work.

Positive lubrication is supplemented by an outer shell of the holder with an "O" ring to reduce wear and allow heavy loads.

Scully-Jones & Co., 1901 So. Rockwell St., Chicago 8, Ill.

Knocked-Down Conveyor Assembles to Any Size

Drive unit with motor and control equipment, and the tail end with a 4-in. tail pulley and tracking idler may be connected by standard 10-ft sections of roller or slider-bed conveyor mounted on H-type stands with return idlers. Belt widths range from 8 in. to 36 in. in 2-in. increments. A wide selection of belt material is available.

Standard speed is approximately 50 fpm and may be varied as desired. The gear-head motor in the drive unit has a 10-in. pulley. Variable-speed drive is also available.

Sage Equipment Co., 30 Essex St., Buffalo 13, N. Y.

IF YOU VALUE FREEDOM

It is impossible to "slip one over" on a lathe, milling machine, or planer. A defective tool breaks down—the dependable tool stays on the job. Kennametal—because its structure is inherently strong, free from flaw and defect, insures faster cutting speeds, more production per tool, fewer tool changes, and lower overall tool costs.

You can depend on Kennametal to machine hard steel—up to 501 Brinell—at high speed, without re-annealing and heat treating. You can depend on it to machine iron castings—hard, burned, and sandy—at faster rates, saving time and materials.

With Kennametal tooling you have freedom to plan a schedule and maintain it—obtaining higher productivity from powerful machines and skilled operators, thus reducing unit costs and adding value to the production dollar.

Your profit is made at the point of the Kennametal cutting tool.

The vigilance of the American public wavered in 1933—and government "slipped one over". The gold coin standard was abandoned, and the dollar was devalued 40%.

Since then, the worth of your savings has been undermined—a bond, insurance, money in the bank has lost over half of its purchasing power. You cannot save for the future with assurance that your savings are secure. A manufacturer cannot set aside a reserve sufficient to pay for equipment that will keep him in business.

Fiat money—a "managed" currency—has always been mismanaged. Today's back-breaking taxes, practically unlimited government spending, and the uncertainty of your future are directly due to unsound money.

These conditions are the breeding grounds of Socialism . . . poisonous to enterprise and initiative . . . death-dealing to personal freedom. A redeemable gold coin standard has always been the only basis for sound, dependable money. Its restoration will prevent embezzlement of your savings—will encourage conditions favorable to personal enterprise—will insure human freedom.

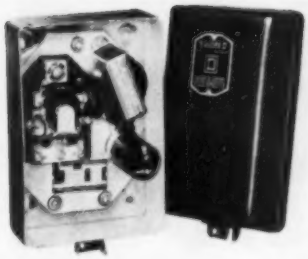
YOU GET MORE
from Less Kennametal

Ask our representatives to demonstrate Kennametal . . . the tooling that reduces costs and increases productivity.

KENNAMETAL®
SUPERIOR CEMENTED CARBIDES
KENNAMETAL Inc., LATROBE, PA.

YOU GET LESS
from More paper money

Ask your Congressman if he is for or against the Reed Bill HR3262. You and other voters must know.

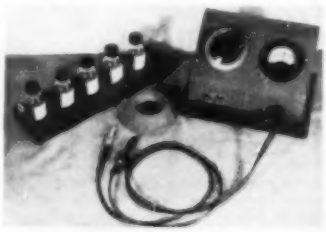


Motor Control Does Automatic Restarting

Square D has developed a motor-control accessory to provide automatic restarting of a motor after a momentary voltage fluctuation or power failure. A time delay, low-voltage release relay, it is used with a separate motor starter and push-button station.

If power failure is prolonged more than a few seconds, the relay circuit "times out," disconnecting the motor from the line, to protect operators and machinery from unexpected restarting. It can be adjusted to give approximately 2-sec or 4-sec delay.

Square D, Industrial Controller Div., 4041 N. Richard St., Milwaukee 12, Wis.



Portable Test Meter Identifies Metal Alloys

A portable metal and alloy identification instrument, known as Electrospot, makes use of the inherent differences in the surface films on metals and alloys to separate them by electrolytic means.

The instrument weighs less than 5 lb and requires no external source of power for operation. Identification of small items is accomplished by dipping a portion of the material in an electrolyte, and for large items by pressing a test probe against the material. Readings can be taken by rotating the dial to produce zero deflection on a millivoltmeter, then reading the dial to identify the alloy. For sorting, a predetermined dial setting is made and deflection of the meter pointer to right or left identifies the material.

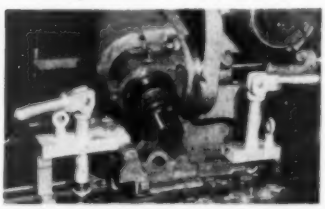
A testing rate as high as 1,000 pieces per hour under production conditions is said to be possible. Identification is based on chemical composition and is not affected by heat-treatment the metal may have received.

Electrochemical Instrument Laboratory, 532 Woodland Ave., Mountainside, N. J.

Trico Gravity-Feed Oiler Now Has Ratchet Adjustment

Gravity-feed oilers now have a ratchet control mechanism for adjustment of the oil feed. A spring mechanism locks the adjustment and avoids the danger of a changing rate of feed from vibration or handling.

Trico Fuse Mfg. Co., 2948 N. 5th St., Milwaukee 12, Wis.

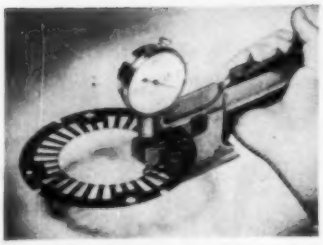


After Adjusting for Job, Naper Clamp Is Cam Operated

The Naper clamp is set up by bringing the clamping bar to rest on the work and locking it. A series of teeth on a cam is turned to mesh with the serrations on the locking post. From then on the work is locked and unlocked by the cam clamp handle.

The standard clamp has a capacity of 4 in. and can be delivered in two to three weeks. Models of special size take four weeks for delivery.

The Naper Clamp Co., Naperville, Ill.



Ames Burr Gage Measures Wear of Punches, Dies

The Ames burr gage is designed to accurately measure the height of burrs in stampings of all materials. As dies and punches wear, a burr is thrown up that may cause difficulty in assembly.

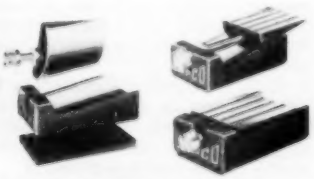
The burr gage takes the guess out of determining the frequency of grinding dies and punches. The amount of burr shows on the dial in direct readings to 0.0005 in. Quarter thousandths can be estimated.

D. C. Ames Co., Waltham Mass.

Electric Tiering Truck Handles Standard Size Two-Face Pallet

The Spacemaker can be furnished to handle any standard size two-face pallet. Forks elevate to 130 in. Over-all length of the loading truck is only 29 in. more than the loading length in the telescopic model and 27 in. longer than the loading length in the non-telescopic unit. Offset drive with stabilizing knee-action caster gives a "cam pattern steering" which facilitates loading in close areas.

Lyon-Raymond Corp., 4769 Madison St., Greene, N. Y.

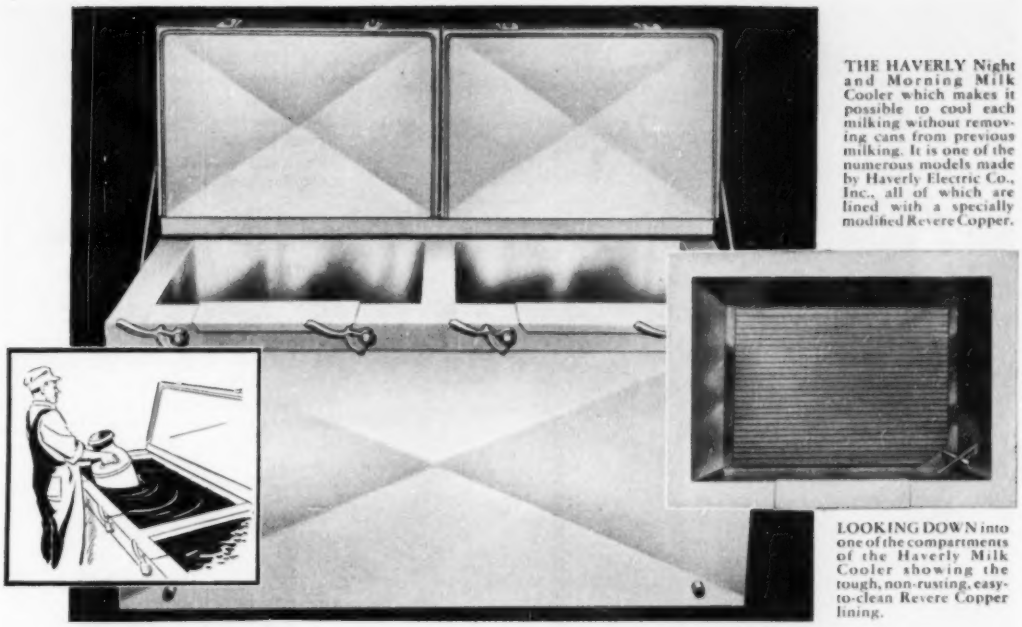


Jacks Level Machines And Isolate Vibrations

Empco machine-leveling jacks include Vi-Sorb vibration-absorbing mounting pads.

The Model JB-V-25 with ¼-in. pad under a load of 92½ psi is said to have reduced vibration 43%, while the Model JB-V-50 with ½-in. pad is said to have reduced it 74%.

Enterprise Machine Parts Corp., 2731 Jerome Ave., Detroit 12, Mich.



THE HAVERLY Night and Morning Milk Cooler which makes it possible to cool each milking without removing cans from previous milking. It is one of the numerous models made by Haverly Electric Co., Inc., all of which are lined with a specially modified Revere Copper.

LOOKING DOWN into one of the compartments of the Haverly Milk Cooler showing the tough, non-rusting, easy-to-clean Revere Copper lining.

HOW COPPER, THE RIGHT COPPER *Increased Sales* OF HAVERLY MILK COOLERS

On farms throughout the country mechanical refrigeration for the cooling of milk has been growing by leaps and bounds. Late in 1945, there were many complaints from the farmers regarding the war-quality rustable material used to line these milk coolers. They were difficult to clean and were rusting out rapidly.

When restrictions were lifted on copper and copper alloys, the Haverly Electric Co., Inc., Syracuse, N. Y., came to Revere to see if non-rusting, easy-to-clean copper could be used. The solution was not as easy as it sounds. For the copper, in addition to its non-rusting and high thermal conductivity properties, also had to be strong enough to withstand the constant banging of 80-lb. cans of milk, and at the same time sufficiently ductile for easy fabrication.

Two Revere sheet metal specialists and their staffs went to work. Tests showed electrolytic copper was not mechanically feasible. Then tests were run with several modified coppers. One of these was found to possess *all* of the requirements.

This use of copper as a liner for milk coolers further resulted in the development of the Haverly "Floating Ice" feature. The ice forms on the side walls of the smooth copper liner; works loose and floats to the surface, adding cracked ice cooling around the top of the can at the cream line, where fast and efficient cooling is needed and proves most profitable. Hence a more efficient unit. Also, due to copper having the highest heat-conductivity of any other commercial metal, copper cooling coils are attached to the outside of the copper lining. This results in greater cooling efficiency and easier cleaning. Here again Revere helped. The Revere welding department developed a fast method of attaching this Revere Dryseal Copper Tube to the lining.

The final outcome is that sales of the Haverly Electric Co., Inc., have increased until they are selling all they can produce of this type cooler, while the mutual knowledge gained has resulted in this company expanding its use of special copper alloys in coolers for other industries.

Perhaps Revere can be of help in developing or improving your product, increasing your sales. Why not call the Revere Sales Office nearest you next time you have a problem in metals?

REVERE

COPPER AND BRASS INCORPORATED

Founded by Paul Revere in 1801

230 Park Avenue, New York 17, New York

Mills: Baltimore, Md.; Chicago, Ill.; Detroit, Mich.; Los Angeles and Riverside, Calif.; New Bedford, Mass.; Rome, N. Y.
Sales Offices in Principal Cities, Distributors Everywhere

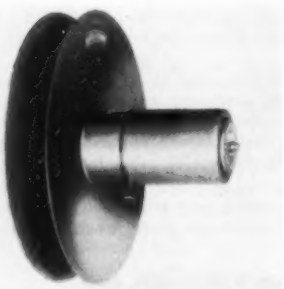
First of Series of Hydraulic Grinders By Abrasive Machine Tool

First of a series of surface grinders with hydraulic operation is the No. 1218 Hydrabrasive. It has a wide crosstravel (12 in.) and a moderate table length (18 in.)

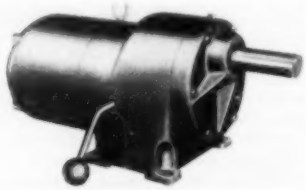
The 12-in. wheel is driven by a 3-hp totally enclosed motor. There is a slow speed range for crush grinding and a fast for conventional work.

Table speeds are almost instantly adjustable from 0.5 fpm to 90 fpm, with $\frac{3}{8}$-in. crossfeed movement in 0.2 sec. The table stops from 90 fpm in 1 in. The Hydrobrasive has saddle ballways for precision transverse adjustment.

Abrasive Machine Tool Co., East Providence 14, R. I.



ROTO-CONE variable-pitch pulleys are now available in the 2- and 3-hp range, Models 1050-20 and 1050-30. The line now includes sizes from ⅛ to 10 hp—*Gerbing Mfg. Corporation, 650 W. Washington Blvd., Chicago 6, Ill.*



Lima Gearshift Drive Provides Multiple Low Speeds

Lima drive Type R3C combines an electric motor with a four-speed transmission having both primary and secondary gear reductions. It is a compact drive providing low multiple output speeds.

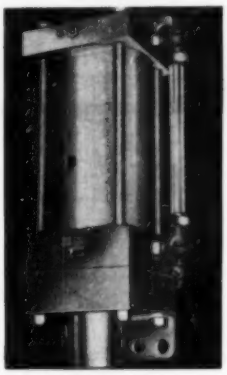
Primary gear ratios are 4.15, 3.15, 1.85, and 1 to 1. A choice of eleven secondary gear ratios is available to give final output speeds ranging from 93 to 1730 rpm. The drives deliver full rated horsepower in each of the four speeds and are available with both constant-torque and constant-horsepower, two-speed motors.

The Lima Electric Motor Co., Dept. AA91, Lima, Ohio

Activated Carbon for Electroplating Is Batch Tested for Effectiveness

Pur-O-Carb activated carbon is said to have the consistent quality and uniformity required for electroplating. It is used to purify bright nickel solutions, and for other acid and alkaline plating solutions. Every production batch is laboratory tested for effectiveness.

Hanson-Van Winkle-Munning Co., Matawan, N. J.



Miller Fluid Pressure Boosters Will Hold Pressure Indefinitely

Fluid pressure boosters that develop hydraulic pressures up to 10,000 psi from ordinary air or hydraulic input pressures are being offered in a range of sizes, pressure ratios, and mounting styles. One booster-driven working cylinder can perform work that might otherwise require an air-cylinder ten times as large. An indefinite number of working cylinders can operate from one booster.

The boosters hold pressure indefinitely without motion or heat generation. Input pressure may be either air or hydraulic, but output is always hydraulic. Operating speeds range from 30 to 450 strokes per min.

Models include single-acting spring-return boosters (illustrated), and double-acting "Air Miser" boosters that save up to 95 percent of the air consumed in single-acting circuits.

Miller Motor Co., 4027 N. Kedzie Ave., Chicago 18, Ill.

COMPLETE from blank to finished gear EQUIPMENT

We're in the business of cutting gear costs—ALL ALONG THE LINE . . . with machines, with tools . . . and WITH SOMETHING ELSE.

Sure we make all types of hobs, shaper cutters and miscellaneous gear tools; gear finishing machines (10 different models) for every kind and size of spur and helical internal and external gear. Sure we developed pre-shave hobs and cutters, Sine-Line gear and hob checkers (13 machines) plus Shear-Speed machines (4 sizes) to cut gears as fast as they can be finished.

But that's only part of the story. Tools and machines are like ingredients in a good stew. Each must be good, but you must also mix them correctly.

When you do:

. . . you can frequently HOB AND SHAVE a gear in LESS TIME than it takes just to hob it. You can also wind up with a lower TOTAL tool cost.

. . . you can cut total tool-change down-time with machines on which you change tools *more* often.

Crazy? Not on your involute.

. . . you can reduce cost of gear cutting by making a change in a *different* operation.

. . . you might get *more* output by *cutting* capital investment in new equipment by 80%.

. . . a different cutter width could easily cut shaving time in half.

Would you like to get your gear cutting tools "for nothing"?

. . . savings in re-grinding time can more than pay for the tools.

. . . raising your gear checking costs could cut over-all gear costs.

Impossible? They've all been done—many, time and again—by Michigan Tool engineers while cutting gear costs ALL ALONG THE LINE for somebody.

How much can we cut yours? Let's find out. Give us a ring or drop us a line.

COMPLETE from blank to finished gear EQUIPMENT

MICHIGAN TOOL COMPANY 7171 E. McNichols Road Detroit 12, U.S.A.

For FASTER Production Milling....

The NEW

MOTCH & MERRYWEATHER

MILLING HEAD

BALANCED SPINDLE, QUILL AND GEAR CONSTRUCTION
ALL GEARS SOLID OR INTEGRAL WITH SHAFTS
MASSIVE STEEL QUILL WITH ADJUSTMENT BY ACME THREAD
HEAVY DUTY, TAPER ROLLER BEARING SUPPORTS
WIDE FACED, HEAVY DUTY HELICAL GEARING
FLYWHEEL ACTION FROM LARGE SOLID DRIVING GEAR
HARDENED, GROUND STEEL WAYS
THESE FEATURES GIVE Rigidity AT THE TOOL POINT!

CAPACITY up to 50 h. p.

Rigidity is needed at the tool point, and the new M. & M. milling head meets this requirement more than amply. Massive, balanced construction prevents vibration, permits heavier cuts and faster feeds, which result in increased production and longer tool life. This new head can be adapted to special production milling machines of our design, which may also combine additional operations into transfer type or trunnion type machines.

Our representative will help you with your problems—no obligation.

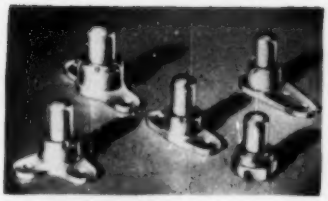
Manufactured by

THE MOTCH & MERRYWEATHER MACHINERY COMPANY

715 PENTON BUILDING • CLEVELAND 13, OHIO

Builders of Circular Sawing Equipment, Production Milling, Automatic and Special Machines

PRODUCTION-WITH-ACCURACY MACHINES AND EQUIPMENT

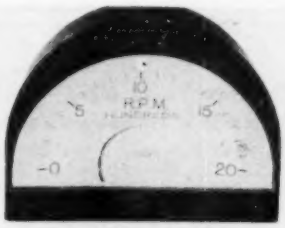


All-Metal Caps Seal Airframe Nuts

A high, light-weight, all-metal cap for some ESNA hex and anchor nuts is designed for airframe and component manufacturers. The cap height on the K3 cap nuts is sufficient to clear AN-3 and AN-4 bolts or AN-509 screws.

The red elastic collar and the new cap form a pressure seal against external or internal liquid and gas pressures of 80 psi.

Elastic Stop Nut Corporation, 2330 Vauxhall Rd., Union, N. J.



Cole Instruments Have Large Scale For Reading at Distance

Instruments with a large, 28¼-in. scale, and a spot-of-light pointer are designed for applications where readings must be taken from a considerable distance. They can be furnished with any type of movement or sensitivity normally obtainable.

They can be calibrated to accuracies from 5% to 0.25% of full scale value. The spot-of-light pointer can be provided with a hairline.

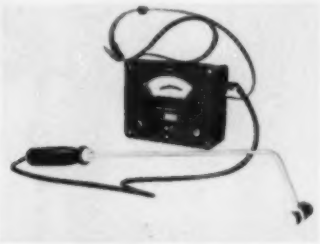
Cole Instrument Co., 1320 South Grand Ave., Los Angeles 15, Calif.

Starters and Disconnectors Combined by Ward Leonard

Bulletin 4120, combination magnetic starters with disconnect switches, are for industrial and commercial use where this arrangement is preferable to separately mounted components Disconnect switches are both fusible and non-fusible type.

Fusible switches fulfill NEC requirements for motor branch circuit over-current protection, disconnecting means, motor-running over-current protection, and motor starter. The non-fusible starters meet all these requirements except for motor branch circuit protection.

Ward Leonard Electric Co., Mount Vernon, N. Y.



Tin-Content Indicator Gives Direct Readings

The Wheelco portable tin-content indicator gives a direct reading of the tin content up to 7% in solder. The test requires a few seconds and eliminates sending samples to a laboratory. The sensing head has a sample of pure lead sealed in one end and a cup for the solder in the other end. The instrument measures the difference in temperature of the two samples while they are passing from liquid to solid consistency. The instrument is calibrated to read directly in percent of tin content.

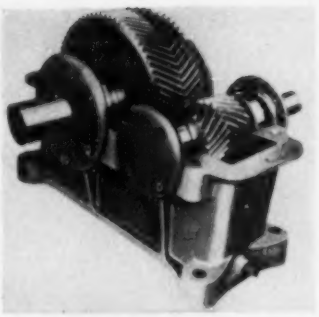
Wheelco Instruments Co., 847 W. Harrison St., Chicago 7, Ill.

Burden Carrier Moves 1 Ton at 20 Mph

The ToteMaster Model GC 2-56 is a carrier with a 2000-lb capacity. It has 21 sq ft of loading space. Powered by a 20-hp, 4-cylinder, water-cooled engine, it is governor controlled for speeds up to 20 mph.

Standard specifications include an electric starter, hydraulic brakes, seat-operated parking brake, and two-wheel drive through a differential. Transmission provides three speeds forward and one in reverse. Price is $990.

Lewis-Shepard Products, Inc., 262 Walnut St., Watertown, Mass.



Heavy-Duty Speed Reducers Carry Overhung Loads

IMO-De Laval herringbone speed reducers are available in single-, double-, and triple-reduction units of ½ to 1000 hp. Center distances range from 4 to 36 in.

The gears are made of electric steel castings or forgings. Shafts turn on high-capacity, anti-friction bearings.

Efficiency is said to be over 98% in single reductions. The reducers are for use where large amounts of power are transmitted.

De Laval Steam Turbine Co., Trenton 2, N. J.

Airco Welding Gloves Come in Three Grades

Three styles of welding gloves have been added to the equipment supplied by Air Reduction. Covering three price ranges, Types *A*, *B*, and *C* are of similar construction. The *A* gloves use the best leather of the three and provide maximum heat resistance. All three gloves are medium-full size.

Air Reduction Sales Co., 60 E. 42nd St., New York 17, N. Y.

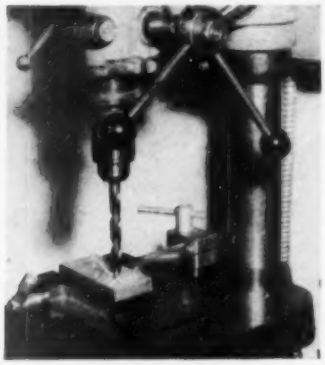
MOISTUREPROOF BAGS protect machine surfaces, tools, and instruments in storage or transit. They can be fabricated from polyethylene only, or polyethylene laminated to foil, kraft, or cloth-backed foil, and printed with trade marks or other information—*The Munson Bag Co., 1343 W. 117th St., Cleveland 7, Ohio*

Ace Tool and Cutter Grinder Mounts Horizontal Ram on Balls

A major improvement has been made in the heavy-duty Ace tool and cutter grinder. The horizontal ram is mounted on a series of ¾-in. balls contained in hardened and ground steel tracks. The unit is rigidly confined and the balls cannot move in any but a pre-determined position. A patented spring pressure maintains the balls and track under constant pressure at all times which compensates for any wear that may occur. With this construction, only 6 oz of pressure are required on the operating hand lever to start the movement.

The spindle drive is now equipped with V-pulleys and belt that provide three grinding speeds. The Ace cutter grinder requires only two fixtures to handle the standard range of milling cutters.

Oliver Instrument Co., Adrian, Mich.

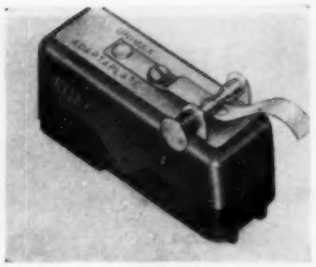


Float-Lock Drillpress Vise Locks in Any Position on Table

Float-Lock drillpress vise can be moved to any position on the table and locked by a quarter turn of the handscrew.

Vise jaws have enclosed screw to keep chips from interfering with operation of moving jaw. The vise can be swung completely out of the way when not in use.

Float-Lock Corp., 824 Glenwood Ave., Bloomfield, N. J.



Unimax Safety Interlock Resets After Manual Closing

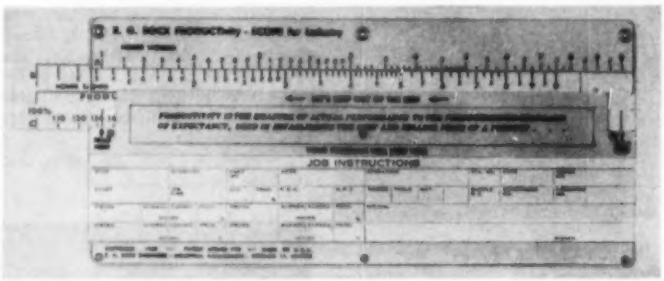
Safety interlock for high-voltage equipment is built so circuit can be manually reclosed for testing, with no danger of being found "hot" later. Leaf-type actuator opens switch contacts when access panel of any inclosure is opened. Slide will reclose the circuit for testing. Switch automatically returns to safety by pressure on the leaf actuator when the door is closed.

Unimax Switch Div., W. L. Maxson Corp., 460 W. 34th St., New York 1, N. Y.

Armstrong Plastic Dip Leaves Thin, Transparent Coating

A plastic dip coating, Seal-Strip, is transparent and said to be thinner and stronger than the brown ethylcellulose base coatings. A hot-dip coating, it can be applied in 2 to 5 sec. The skin-tight coating can be slit and peeled off like other plastic coatings.

Armstrong's Seal-Strip, Inc., 854 Fifth Ave., New York 1, N. Y.



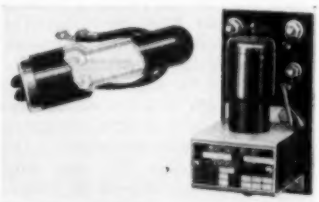
Productivity-Scope Spots Jobs That Fall Behind Schedule

The Productivity-Scope is designed to measure and signal performance while a job is running. A plastic unit with scales calibrated in terms of hours worked and hours earned, it is attached to each machine or placed on each worker's bench.

Periodically during the day the number of units finished is counted, and the quantity interpreted in terms of earned hours. Space is provided for recording this on a job instruction slip which slips into a slot in base of the plastic case.

When the hours earned are set on the movable scale below the hours worked on the fixed scale, the percentage productivity can be read. A green signal shows if productivity is above standard, and a red signal if it is below standard. Supervisory personnel can readily see which jobs are falling behind schedule.

R. G. Bock Engineers, Lincoln National Bank Bldg., 1951 Irving Park Rd., Chicago 13, Ill.



Durakool Switches and Relays Use Triple-Distilled Mercury

Mercury switches and timer-relays built by Durakool now incorporate three modifications designed to add to their life.

First is the change to triple-distilled mercury which is cleaner than that previously used. Second is a higher-arc ceramic, and third is a metal-conditioning process said to reduce resistance.

Durakool Inc., Elkhart, Ind.

RADIOGRAPHY pointed the way to sound production

Radiography revealed a recurring irregularity in a simple production casting—showing the need for a change in casting procedure.

Simple castings are not always soundly made the first try. These were for a customer who had learned to expect highest quality from the foundry.

The first group cast was checked radiographically. Similar irregularities were found in nearly every part, indicating the need for a change in casting procedure. With the help of radiography the change was made with a minimum of lost time, and sound parts were quickly cast and delivered to the customer.

Any foundry that seeks a reputation for producing consistently sound castings will find radiography an invaluable aid. It detects irregularities. It pictures the effects of changes in gating, venting, pouring temperatures, chilling, and other variables. It pays for itself from savings in development time and in reduced rejections—builds customer good will.

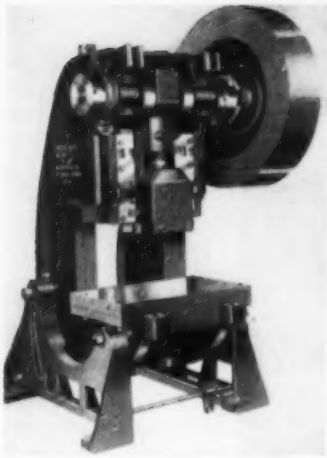
Ask your x-ray dealer to explain all the ways radiography can help you increase yield and cut costs, or ask Kodak for a copy of "Radiography as a Foundry Tool."

EASTMAN KODAK COMPANY
X-ray Division
Rochester 4, N. Y.

Radiography . . .

another important function of photography

Kodak
TRADE-MARK



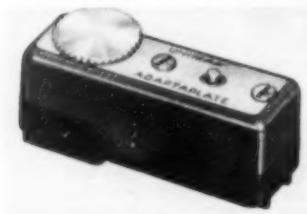
Frame Has Built-In Tierods On Sales Service 85-Ton Press

The 85-ton open-back inclinable Press-Rite power press has a one-piece alloy frame with built-in tie-rods.

Design of the press is similar to the smaller models previously introduced. It includes non-repeat single-stroke mechanism and automatic cam-actuated brake.

Bolster area is 22x36 in. and depth of throat is 12 in. Shut heights and strokes are optional. It can be fuf-furnished with either flywheel drive, back geared, standard sliding-key clutch, or air-friction clutch and brake.

Sales Service Machine Tool Co., 2363 University Ave., St. Paul 4, Minn.



Unimax Precision Switch Has Variable Differential Motion

A knurled knob on the Type MX-1-Z25 snap-acting precision switch gives a variable differential motion. It may be fixed anywhere within the range of 0.0005 to 0.008 in.

Designed to compensate for variation in working-range tolerances of critical pressure and thermostatic controls and timing devices, the adjustment is made in assembly.

Unimax Switch Div., W. L. Maxson Corp., 461 W. 84th St., New York 1, N. Y.

Automatic Clamp Doubles Bending-Machine Production

Speed of the Bendix air-compression tubular bending machine is said to have been doubled through the development of a new automatic clamp. Up to 800 or 900 precision bends can now be made per hr on 1-in. 16-gage tubing. The machine has one easily accessible lever which controls all bending and return of the bending head. It is powered by a Hanna cylinder so there is no clutch brake or motor to wear out.

Paul Machine Tool & Die Works, 4612 S. Kedzie Ave., Chicago 32, Ill.

Vinco Automatic Center Punch Adjusts Pressure From 5 to 35 Lb

Model C-15 R automatic center punch is an improved model with an adjustment sleeve to permit visual variation of spring pressure from 5 to 35 lb. Like the previous model, it consists of an internal spring-actuated hammer which is released upon hand pressure to strike the tool-steel point.

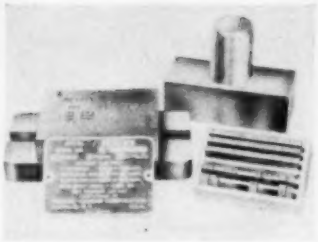
A ball top has been added for hand comfort. Among accessories are a tungsten carbide point for marking hard steel and a self-centering attachment for mounting hinges and brackets.

Vinco Products, 915-17 Asbury Ave., Asbury Park, N. J.

3E Lubricant Non-Poisonous Substitute for White Lead

A heavy paste that can be thinned with light lubricating oil is a non-poisonous substitute for white lead as a production lubricant. Called 3-E Lubricant, it is lighter in weight and said to be more easily cleaned than white lead.

Wayne Chemical Products Co., 9475 Copeland, Detroit 17, Mich.



Cunningham Nameplate Marker Fits Small Production Presses

Stamping fixture for mass production marking of nameplates is designed for use in a small power press, screw press, or kick press. It consists of a chase block which contains the steel marking letters and a striking block held in the throat of the press. Slots to hold the letters are machined out of the chase block to suit the design of the nameplate.

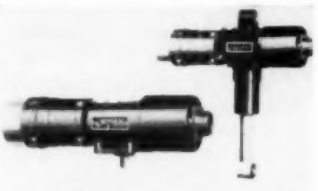
M. E. Cunningham Co., 95 East Carson St., Pittsburgh 19, Pa.

Safe-T-Kut Tools Inspected By Magnetic-Particle Method

Safe-T-Kut line of tools includes hand chisels, pneumatic- and electric-hammer chisels, center punches, and similar tools. They are made from the same steel used in the standard tools, but with these differences in manufacturing:

Magnetic-particle inspection is made of each tool, rather than by sampling methods. The striking end has a broad radius which removes much of the metal coming in contact with a striking hammer. This end also receives special heat-treatment to make it hard enough to resist mushrooming, but not hard enough to cause spalling.

Delaware Tool Steel Corp., Wilmington, Delaware



ROTARY AND LINEAR ACTUATORS now operate directly from 110 volt, 60 cycle, single-phase ac. They are still available for low-voltage direct current for which they were designed. The new models eliminate need for a rectifier—*Airborne Accessories Corporation, 25 Montgomery St., Hillside 5, N. J.*

METAL SHOW VISITORS

35,588 STRONG...

22% DECIDED TO BUY SOMETHING THEY SAW AT THE METAL SHOW*

10% BOUGHT SOMETHING DIFFERENT FROM WHAT THEY HAD PLANNED AFTER SEEING IT AT THE METAL SHOW*

20% COMPLETED A DECISION TO BUY SOMETHING AFTER SEEING IT AT THE METAL SHOW*

You can't find a better audience than the one that attends the Metal Show.

Showing your products and services to over 30,000 men vitally interested in all phases of metal production and fabrication, gives you the best opportunity to sell what you have to the metal industry—to show how it will help achieve "Economy-in-Production".

Join the nearly 400 manufacturers that will display at the 1950 Metal Show. If you haven't received floor plans, write W. H. Eisenman, Managing Director, 7301 Euclid Avenue, Cleveland 3, Ohio.

**From Attendance Report No. 4 in a continuing analysis of Metal Show visitors. If you have not received a copy write National Metal Congress & Exposition, 7301 Euclid Avenue, Cleveland 3, Ohio.*

METAL SHOW

OCT. 23-27, 1950

INTERNATIONAL AMPHITHEATER, CHICAGO, ILL.

Sponsoring Societies

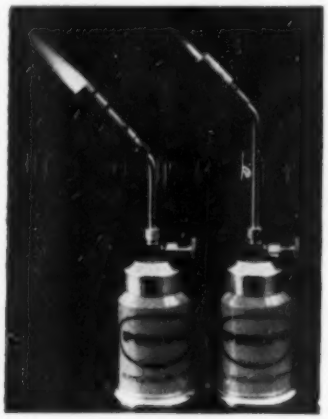
American Society for Metals **American Welding Society**
Institute of Metals Div.—A.I.M.E.
Society for Non-Destructive Testing

Clark 10,000-lb Lift Truck Eliminates Friction Clutch

The Utilitruc-100 is a 10,000-lb capacity fork-lift truck, gasoline powered and equipped with Dynatork Drive. The drive transmits engine power through a magnetic field, across an air gap, eliminating any friction clutch. The conventional transmission is also eliminated, and replaced by constant-mesh forward-and-reverse gearing.

The truck is powered with a 6-cylinder Continental industrial engine developing 50 brake horsepower at 1800 rpm. Outside turning radius is 104 in. and inside turning radius 12 in.

Clark Equipment Co., Industrial Truck Div., Battle Creek, Mich.



Portable 2200 F Flame Tool Requires No Pumping or Priming

A self-pressurizing fuel for flame tools called Prepo is packaged in a seamless throw-away container.

The fuel fits in the holder of a hand torch which requires no pumping or priming. At present available in two tips, the torch lights instantly and burns with a clean, blue flame at 2200 F. A can of fuel lasts 1½ hr with the large tip and 4 hr with the small tip. The valve seals the can when not in use.

The torch is intended primarily for applications needing such a flame occasionally, or when portability is important. The fuel is a mixture of hydrocarbons that is odorless and nontoxic. An artificial odor has been added to warn of open valves.

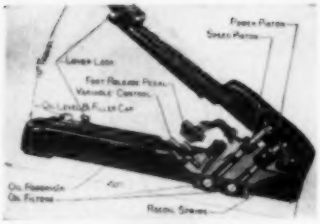
Pressure Products Corp., 140 N. Dearborn St., Chicago 2, Ill.

Security Spring-Steel Retainers Lock Studs, Bolts in Assembly

Elliptical spring-steel retainers which are forced into circular shape, creating locking pressure, can now be applied to studs, bolts, and other threaded parts in mechanical assemblies.

These Studlocs are made in standard stud and bolt sizes from ⅜ to 2 in. in both NC and NF thread series. They are similar to the Security locknuts previously introduced.

Security Locknut Corp., 1815 N. Long Ave., Chicago 39, Ill.



Foot-Operated Hydraulic Jack Has Two Operating Speeds

The Go-Jak foot-operated hydraulic jack develops up to 20 tons force. It has two speeds with a patented selector valve. The pedal forces the ram out quickly until the work is contacted, when the unit changes automatically from high to low speed. For light work the selector can be set for the jack to operate at high speed when under load.

Total weight of the jack is 10 lb. It is made for ⅜ in. external pipe fittings. The unit is 19½ in. long in locking position.

Wihtol Industries, Lewis Street Eatontown, N. J.

Ajax Hultgren Salt Baths Equipped With Submerged Electrodes

Ajax Hultgren salt-bath furnaces are now equipped with submerged electrodes. This patented design is intended for salt baths operating at temperatures from 1700 to 2400 F and for deep baths.

Instead of entering from the top of the bath, the electrodes enter through the back wall of the furnace just below the bath surface. They are closely spaced to produce electrodynamic stirring action which is said to provide temperature uniformity within 5 F.

Because electrodes are not exposed to the severe oxidizing action at and above the bath surface, electrode life is six months to three years. Though less frequent, electrode replacement is not as easy as with the standard design.

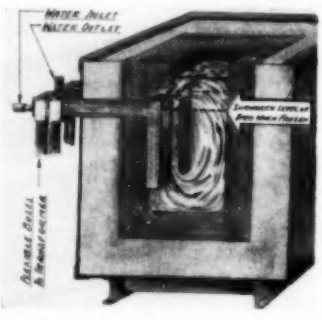
Submerged electrodes are at present restricted to ceramic pots. For this reason they are not recommended for cyanide hardening, carburizing, descaling, cleaning, desanding or for use with nitrate salts. Welded steel pots give the best service for these applications.

Submerged electrodes are recommended for deep baths for heat-treating long work from 1100 F upward, for hardening high-speed steel tools at 2200 to 2375 F, for high-carbon, high-chromium dies at 1850 F, and for all operations carried out in neutral salts above 1700 F. These include neutral hardening carbon and alloy steel, annealing and hardening stainless steel, and heating for forging and brazing.

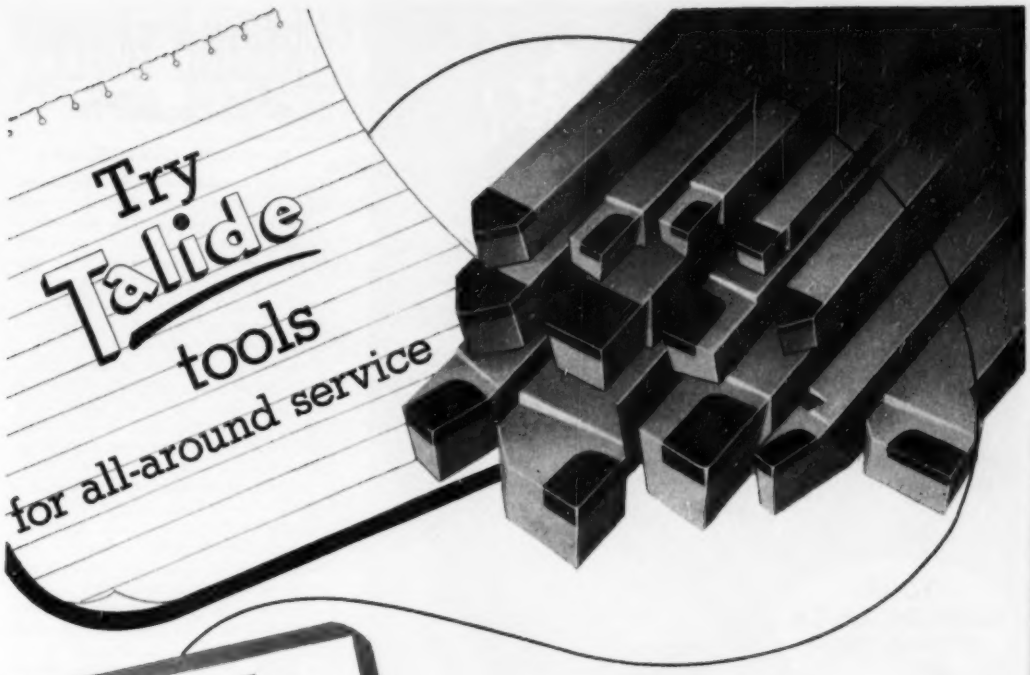
Bath surface is reduced to the desired working area which reduces power consumption as much as 30%.

Should the bath freeze, the salt will shrink sufficiently to expose the electrodes for restarting in a manner similar to the standard design by melting salt between electrodes.

Ajax Electric Co., Inc., Frankford Ave. at Delaware, Philadephia 23, Pa.



Try Talide tools for all-around service



● How's your service on Carbide Tools and Tips? Such as advice or suggestions applying specifically to your machines and your requirements? The Talide salesman, who calls at your plant, is a qualified application engineer. He can roll up his sleeves and go to work.

How about fast service on Tools and Tips? There are Talide warehouses in Newark, N. J.; Youngstown, Ohio; Detroit, Mich.; and Chicago, Ill. You can have Talide Tools and Tips within 24 hours.

If you want specifications on grades and types, write for your engineering-style catalog 48-T on Standard Talide Tools and Tips.

Talide Carbide Tools cut and machine two to three times faster than any other metal. They stay sharp longer and take heavier cuts. Talide Tools eliminate most "down time" on turning, boring and facing operations.

Tie to Talide Tools and Tips for all-around service. Call our nearest application engineer or write to us at Youngstown and outline your problem.

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FOR PRECISION FASTENINGS TO RESIST CORROSION...
Allen ⬡ Head Stainless Steel Set & Cap Screws
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When you need a combination of strength and resistance to most acids, alkalies or other corrosive substances, use stainless steel.

When you require stainless steel cap or set screws, your Allen Distributor has *the most complete line* . . . over seventy sizes that are standard.

You get the convenience of prompt delivery plus the regular Allen ⬡ Head advantages of strength, fine finish, strong sockets and the smooth threading made possible by Allen 100% Pressur-forming. *Sold only through leading distributors.* Write for complete information on the Allen ⬡ Head stainless steel line.

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Made of 18-8 stainless steel. NC threaded. (No. 10 NF also standard.)

Set Screws in popular sizes from No. 6, 3/16" length to ½" x ¾". Cup points.

Cap Screws in popular sizes from No. 8, ⅜" length under head, to ½" x 2" under head. Other threads, points and types of stainless steel available on special order.

WARNING
Allen-Type screws aren't necessarily Allen-Made.
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FOR 40 YEARS THE BUY-WORD FOR SOCKET SCREWS

ROUND TABLE Discussion

PLANNING COMMISSION

Costs of running a plant today have reached staggering proportions and whoever is responsible for the policy of any concern has got to do a far better job of planning than in the past to be able to pay their way and have a margin of profit that the Company has to get in order to keep out of the red and keep going.

Seeing they do not have a planning commission, Ed has informed Al that when he is finished he is going to the Big Boss and recommend that new equipment should replace his old and worn machines.

Well I know from similar experience I had along with two other equally hopeful young foremen around 1904 that Ed is due for the surprise of his life when he gets his interview with the Big Boss.

In the huge plant where we were employed most foremen were getting more than the usual amount of rejected parts from inspection. When the men responsible for the pieces were interrogated about them they invariably stated that while they may be partly to blame, the chief cause was old and defective equipment.

I might say here that all work was for the government—Army and Navy guns, air craft engines, etc., all requiring greatest accuracy and the finest equipment obtainable. We had the finest class of machinists, but most equipment was 15 to 30 years old.

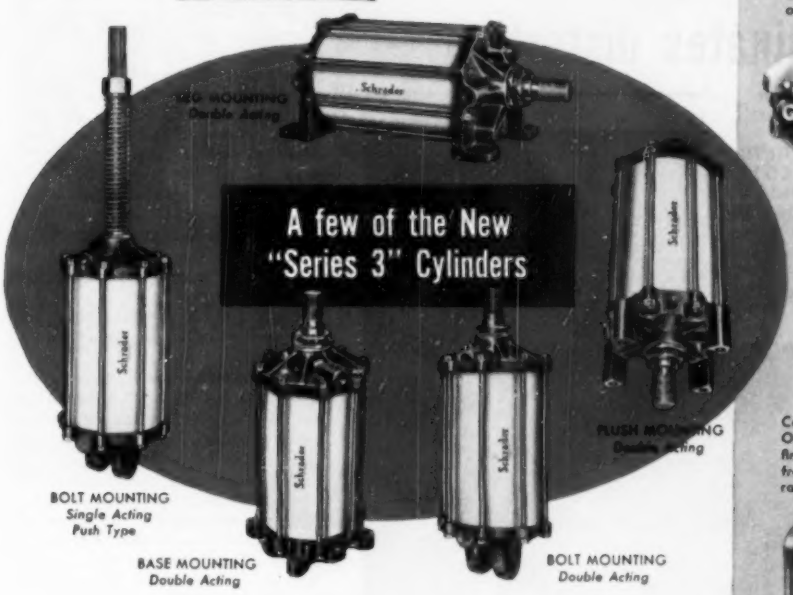
Two other young foremen and I were discussing the problem and finally arranged to try and get an interview with the Big Boss to see if something could not be done to buy a lot of up-to-date equipment. We talked to the superintendent, who said that he had been trying his best the last two years to obtain new equipment and hadn't got anywhere at all. But if we wanted to see what we could do he would see if he could get us a chance to talk to the Big Boss and hoped we had better luck.

Well, we got our interview and we also learned a lot about expenses of running a plant that we were not aware of.

His last words were, when we were leaving, "I'm glad to have talked to you fellows, and just as soon as you can put before me something constructive in the way of justifying the outlay of money required which

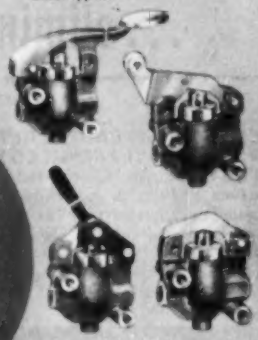
Make hard work EASY with BRUTE POWER

from these BRAWNY NEW AIR CYLINDERS



Poppet Type Valves

These are 3-way with roller lever, solid angle lever, hand lever, and hand lockdown lever. Some valves available in 2-way. The complete Schrader catalog shows many other types.



New 4-Way Valve

Completely new in design. Operates at the touch of a finger. Diaphragm seat. Large free air capacity. Ports arranged for hidden piping.

Improved Design Pilot Valve

One of many types of Schrader Pilot Valves, 2 or 3-way, with or without timer.

What's your problem? Operating press brakes, clutches, doors, clamping work, lifting or lowering, pushing or pulling heavy loads?

Investigate the time-saving, work-saving advantages of the new Schrader Air Cylinders. See how they do hard jobs faster, safer, better.

See what Schrader has done to make this new series of air cylinders tops for ruggedness, for fast cycle operation, and ease of mounting. See how interchangeability of the parts cuts down maintenance.

WIDE RANGE OF SIZES AND TYPES

These new Schrader Air Cylinders come in a range of sizes and types broad enough to satisfy anyone—single acting (push or pull), double acting (with or without adjustable cushion), in a variety of mountings, and in cylinder diameters from 1" to 8" bore, and in any stroke.

NEW BANTAM-SIZE AIR CLAMPS—Small, powerful light-weight. Base or leg mounting. Six models in each type. Strokes 1" to 2", cylinder diameters 1", 2¼" and 3". Low in cost.

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Air Strainers	
Uniflare Tube Fittings	

Aircomatic Welding cuts production time 80% ...eliminates distortion

CONSOLIDATED WELDING AND ENGINEERING COMPANY, Chicago, Illinois, faced a serious problem in the welding of aluminum air separators. The methods considered couldn't handle the variety of thicknesses involved economically. Furthermore, they were slow and cumbersome, and raised many distortion problems.

J. E. Szymczak, Airco Technical Sales Representative, was called in. He suggested using the Aircomatic Process with Airco 1/16" 43s wire for the filler.

Major production and cost problems were solved immediately. For example, to weld two complete separator assemblies, including all the baffles, required only 180 man hours—about one-fifth the time of other methods considered . . . a tremendous time and money saving advantage.

Further, Aircomatic, with its high specific rate of energy input, and great welding speed, confined the heating effects to the narrow weld-zone . . . thus, completely eliminating the problem of distortion. Consolidated officials were delighted with these results, and placed the Aircomatic in operation at once.

Perhaps this unique welding technique can help you solve an important fabrication problem — so write your nearby Airco Office for Technical Sales assistance or for a copy of Aircomatic Welding Bulletin ADC-661.

AIRCO **AIR REDUCTION**

Offices in Principal Cities

TECHNICAL SALES SERVICE—ANOTHER AIRCO PLUS-VALUE FOR CUSTOMERS

would be very large, then I promise you something will be done. I am keenly aware of the need of new equipment.

When I got home that evening, my *American Machinist* London Edition had arrived. I noticed that there was to be a machine tool exhibition at Manchester in a couple of weeks. I talked it over with my two fellow-foremen and we all decided to go for three days, to get facts and figures, cost of equipment, to find out what savings and time and money the investment would mean to the company.

We got our superintendent to get us a dozen prints of about three dozen pieces of principal parts we machined in the shop showing material, all operations, quantities required.

We got from the cost office, the total cost of each piece, machined in our plant.

Superintendent gladly gave us permission to take time off. Incidentally, we lost three days pay plus rail and hotel expenses, but we had a lot of fun.

We thoroughly investigated the equipment on display—lots of U.S.A., English, some French and Swiss. We gave out to those in charge of booths, copies of parts we would like estimates on. We asked for operation sheets and cost of equipment. We got wonderful cooperation from everyone. We requested that they send quotations to the Big Shot and a copy to us.

About a month later we received estimates from U.S.A. We already had received some from English concerns. Then from Swiss Co. and of course Big Shot had also received them. These estimates showed large savings in cost in comparison to ours.

We had informed the Big Shot on our return, where we had been and what we had been doing and requested him to see the sales engineers himself if possible when they came to call on him. The representatives were courteously received not only by Big Shot but by three top engineers. We never knew if our little experiment had any real influence but it is true that about 30 various types of machine tools were bought in the next six months from U.S.A. and a like quantity from English and Swiss concerns.

Arthur Silvester
Niantic, Conn.

•

THE DECISION as to just when a machine should be replaced because of its age and condition calls for the consideration of a number of factors. Among these are quantity, cost,

STRAIGHT

as a beeline

. . . any way you look at it

A FILE in the making faces many temptations to stray from the straight-and-narrow path. But Nicholson manufacture patrols every step from forging to finishing.

Not only is straightness essential for doing a good filing job—especially where accurate stroking is required—but it is also evidence that the blank has been evenly surfaced and annealed, the teeth carefully cut, and the file uniformly hardened.

Yet this is only part of the story of Nicholson quality. Maintaining rigid standards in the high carbon steel used; guarding against decarbonization during the manufacturing processes; *testing each individual file* for soundness, sharpness and durability . . . these add to the combination of factors that make Nicholson and Black Diamond really great files.

Their purchase cost is insignificant in relation to the better work, increased production, and savings in workmen's time they enable. For these good reasons, they're the brands most industrial distributors prefer to handle.

"FILE FILOSOPHY," Nicholson's famous 48-page illustrated book (16th edition) on manufacture, kinds, use and care of files, will give your executive, purchasing, production and shop heads further valuable information. How many copies? *Free.*

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Multi-Start Threads *plus* Automatic Indexing!

35 Seconds
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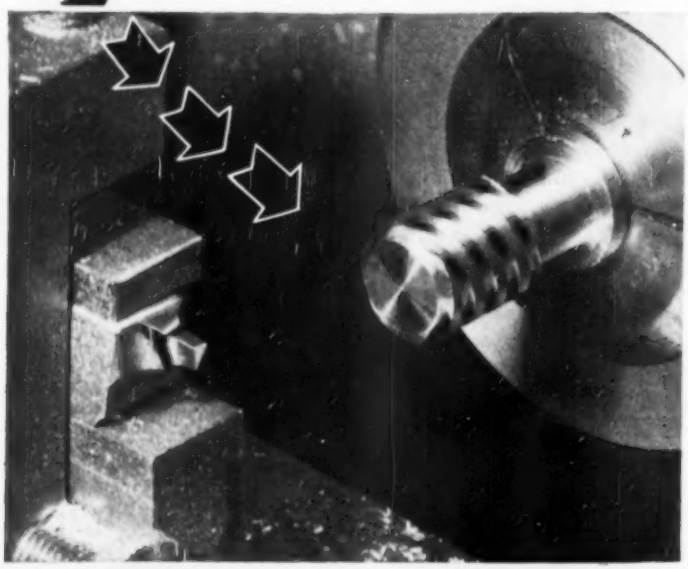
3-Start
12 Passes
550 RPM
2M pcs. per Sharpening
25/35 sharpenings/tool
$3.20 Tool cost

If you get multi-start threading jobs, cast your eyes on the production figures for threading this valve stem!

YOU'VE REALLY GOT SOMETHING when you generate threads on the Cri-Dan Single Point High Speed Semi-Automatic Threading Machine!

Frankly and in all sincerity, for "plus" advantages in generating threads up to 4-inch diameter, no other machine even approaches the Cri-Dan for versatility, for speed, for quick changeover, for low tool cost, for precision threads . . . what's more, the Cri-Dan generates 'em all . . . external, internal, right or left-hand, tapered, triangular, square, multi-start, buttress, trapezoidal, round or special threads.

Get up-to-date on thread-generating . . . send for Cri-Dan Bulletin 75-A.



The LEES-BRADNER Company
CLEVELAND 11, OHIO U.S.A.

and volume of production on the one hand and that of finance on the other. These may be viewed by people whose understanding and primary interests are different and the decisions made may not be truly logical or in the real interests of the company. To the Old Man a machine represents an item of capital as well as a producing unit. Its value may have been written down but it still has some residual capital value and will produce. To the works manager and foreman, it is a tool which, while it may have given good service, and because of that service, is now definitely less useful. Its slides may be bad; its fine alignment gone; its bearings, spindles, and gears loose, and rattle and chatter. In consequence its work is not so good, and takes more time and may require more rectification.

The evidence of these facts should be in the firm's cost and production records. For work done on an old, worn-out machine, where premium or piecework systems are in use, it is often necessary to allow extra time or money, over and above that allowed for operations done on machines in good order. The account for repairs may also be higher. Also where machines are scheduled for output, the lower output programmed would be significant. The information thus made available should obviate any kind of nervous agitation or fear on the part of any person about to recommend the purchase of a new machine. Let the machines talk for themselves, provided the evidence of their own inability to remain in the vanguard and, thereby, voice the need for their replacement.

When this evidence is presented to the Old Man, if he has any sense of discrimination, he will be more likely to be agreeable than annoyed. He may even ask for the figures to be aggregated and calculated as an hourly on-cost addition for that particular machine. He will be as much against wasting money one way or another whether in driblets or chunks.

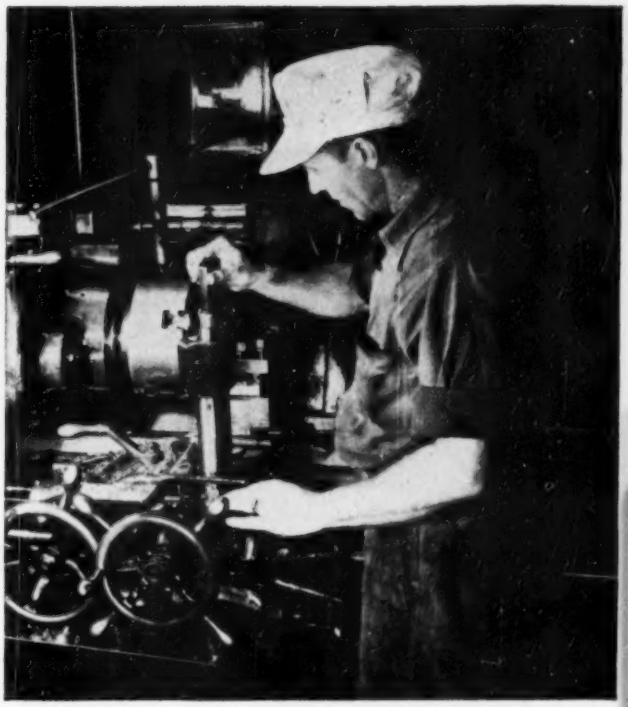
P. E. James
Lindum, England

•

BROTHER'S KEEPER

TODAY our advanced study of psychology marks such people with the traits mentioned as victims of kleptomania. I have come in contact with them in a number of places. Some have done petty thieving. Others borrow tools or money then go on expecting a person to forget. I have found them committing petty mis-

THE CLOSER THE TOLERANCES ON STAINLESS STEEL PARTS—THE MORE YOU NEED...



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Wherever sanitation, corrosion-resistance or heat-resistance enter the steel parts picture, the obvious answer is Republic ENDURO Stainless Steel.

That's why Republic—world's largest producer of alloy and stainless steels—offers you a choice of three different grades of Free-Machining ENDURO Cold Finished Bars, for maximum production without sacrifice of chemical or physical properties.

All such Free-Machining grades—in both chromium and chromium-nickel—are processed by Republic's Union Drawn Steel Division. Two of these grades, for instance—ENDURO FC (Type 416) and ENDURO AA-FM (Type 430F) provide machinability equivalent to approximately 90% that of regular Bessemer screw stock. All these grades give you fine surface finish, accuracy of section and uniform soundness.

Republic metallurgists are ready to give you prompt assistance in determining where and how you can get the greatest benefits from ENDURO Stainless Steel in Free-Machining grades. Write, wire or phone *today*.

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"How Tool Costs Were Cut 12 Ways in 20 Plants" reports how manufacturers large and small have eliminated such delays with McCaskey Control. Reports of other big savings are told in the words of responsible plant executives . . . results and how they have been secured. They all add up to substantially lower tool expense and improved operating efficiency.

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chief and in one case the man was a perpetual tattler while he would transgress rules as badly as those he tattled on. My observations lead me to believe that most of these people are smart and it leads them to practice this cunning habit on their fellow men. As they are problem people who can become a menace you must control them or dismiss them outright. I regret to see them thrown out of a shop to begin anew because there is the possibility that you are dumping them on the next innocent plant.

The petty tool lifter is very disgusting. He can graduate into a lifter of large company tools like electric drills, etc. Examples of treatment of several cases I have met may help others. We broke the borrower by having his friend who made the loan present when he got the check at the cashier's window. When he repeated and he being married, his wife was notified. That ended that affair.

In petty tool lifting we discovered it to be a parts inspector. His last act being the theft of a pair of small dividers. I had his department called to a conference, stated the reason and that I knew the man. Informing them that the individual would get his time and be revealed if the dividers did not return before quitting time I let them go to work. In less than one hour the dividers returned.

In the case of the habitual tattler I could not just brush him off. He would no doubt get the idea I was not interested and spread his opinion. So as I had marked some of his slight irregularities, I drew his attention to his own faults in a courteous but meant-what-I-said way. This brought him up sharp to be on his own toes and I had no further remarks about others from him. When you deal with these cases you must do so for general plant morale and protection as well as the individual person. In case you are hiring a known one of these klepto's I leave the matter up to the party that is hiring. If he wants to chance a trial of the man then it's his headache.

Henry Rasmussen
Niagara Falls, N. Y.

•

"ALTERNATE DELEGATE"

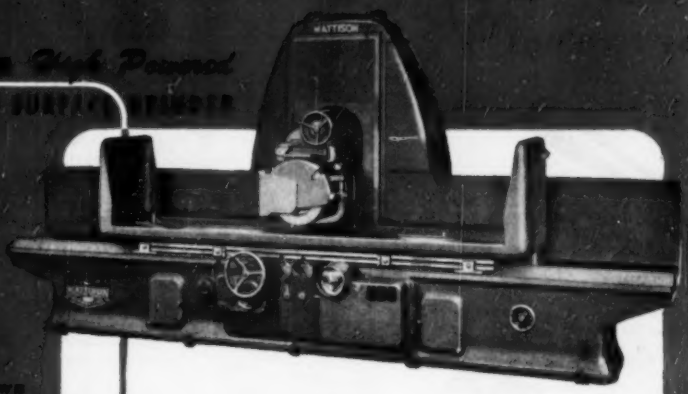
Longfellow once wrote, "All things come round to him who will but wait." The patient worker who is kept in a job he is doing well, if he can see promotion ahead, should not feel that he is in the same position as an "alternate delegate" at a convention with nothing to do or

MATTISON GRINDERS

MATTISON *High Powered*
PRECISION SURFACE GRINDERS

● Mattison Machine Works, Rockford, Illinois has purchased the line of Production Grinding Machinery formerly made by the Hanchett Manufacturing Company of Big Rapids, Michigan. These machines will supplement the well-known line of Mattison High Powered Precision Surface Grinders and enables Mattison Machine Works to offer machines for handling practically all of your Surface Grinding problems on a low cost, high-production basis.

For further information on any of our Grinders listed, ask for free circulars containing complete specifications and operating data.



MATTISON GRINDER
HANCHETT PLANO TYPE

Grinders now built by MATTISON

SURFACE GRINDERS: High-Powered, Precision, Horizontal Spindle —Rotary Type, Vertical Spindle— Rotary Automatics, Vertical Spindle — Reciprocating Table Type, Vertical Spindle — Plano Type, Horizontal and Vertical Spindle.

FACE GRINDERS: Traveling Table (Hydraulic) and Traveling Wheel.

DISC GRINDERS: Single Spindle, Double Spindle, Vertical Spindle, Automatic Single Wheel.

WAY GRINDERS: Vertical Spindle for dovetails and undercuts.

ABRASIVE-BELT GRINDING AND POLISHING MACHINES for wide steel sheets, strip steel, internal tube, etc.

● For years Mattison Machine Works has successfully built High-Powered Precision Surface Grinders and will continue to build the same high quality into the entire line — through sound principles of engineering, precision manufacturing, careful workmanship and modern methods of production. Our reputation for service and careful attention to machines in the field will naturally extend over the complete line of Grinders now built by Mattison.

MATTISON MACHINE WORKS
ROCKFORD • ILLINOIS

don't scrap metal by turning!

...save by Swaging

on TORRINGTON SWAGERS

The Torrington Rotary Swaging Machine uses every bit of stock. With 4000 hammer blows a minute, swaging reduces, sizes, rounds, tapers and points rod, wire and tubing. It makes metal tougher and more resilient. It hammers away minor surface defects.

Torrington Swagers are built to a mechanical perfection based on our 42 years' swaging experience. Send today for your free copy of the illustrated booklet describing the machine and the method.

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Please send a copy of "The Torrington Swaging Machine" to:

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say unless the delegate drops dead.

Good management should encourage ambition in its workers; provide the opportunity for advancement, promote from within and make such promotion possible. If the "alternate delegate" for the higher position in the shop is slated to fill the higher job later, why shouldn't management assure that the present executive will have a competent and able understudy? It would therefore seem that the proper course of management to follow in this case would be to groom the candidate for the higher job by taking him off the present job he is doing so well and let him try his hand on other jobs within the shop until the higher position he's slated for opens up. This diversified experience will preclude the possibility of his getting too far away from the over-all requirements of the higher job so that he won't be able to handle it when the time comes.

Good management knows that "behind an able man there are always other able men." However, it's always good management to give a man a step-up, no matter how well he is doing his present job. The least that management can do in this particular case is to groom the man.

Too many executives are afraid that another employee may get their jobs. They should realize that their own promotions depend on their having trained understudies. Unpredictable changes make it necessary for management to keep on tap a supply of key men. A Number One man requires a complementary Number Two man to provide continuous operation of a plant. Time and tide have no respect for the best laid schemes of men and management. A substitute or "alternate delegate" for each executive within an organization is essential. This substitute must be available to act in case of illness or enforced absence of the supervisor and must be capable of taking over his work in case of death or change of duties.

The best interests of management demand that the most efficient and capable worker be selected as the possible future Number One man, or general foreman in this case. The potential general foreman must also be judged on the basis of his leadership qualities, as well as his capabilities as a mechanic. Selection on the basis of worker efficiency, sound judgment, and experience in the work will prove of value to both management and labor. Experience on the different jobs in the shop would help to groom the candidate for general foreman.

Although ability may be of little

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Enthusiastic operators report cutting from 30-50% more metal with MILFORD Wavy Set band saw blades than with many other standard raker set blades. Hard, strong teeth are set deep into the back of the blade — rippage is practically eliminated. The MILFORD Wavy Set clears chips from the cutting area quickly, makes working to close tolerances easier, prolongs blade life. Try a MILFORD Wavy Set today, and cut yourself in for some big savings in time and money. Select Industrial Distributors can serve you from stock.

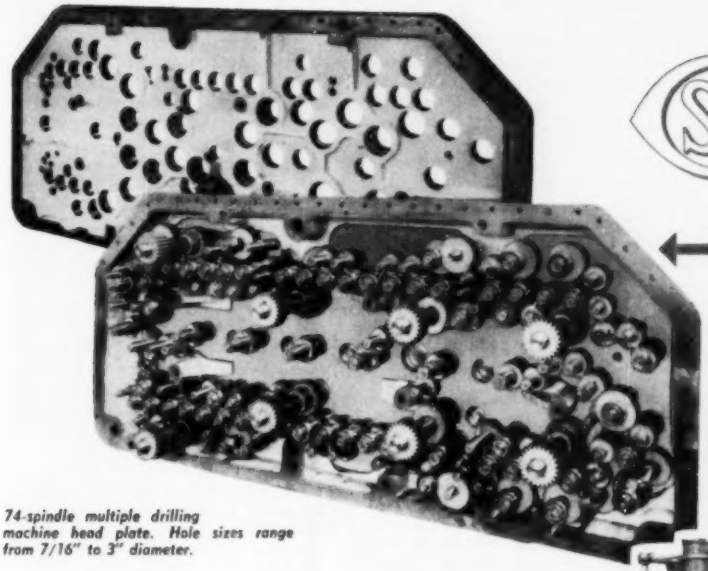
THIS BOOKLET tells you more. Get your copy, and other literature on the complete line, from your MILFORD Distributor today. Or, write direct to the factory — TODAY.

THE HENRY G. THOMPSON & SON CO.
Saw Specialists Exclusively For Over 70 Years
NEW HAVEN 5, CONNECTICUT, U.S.A.

Profile and Band Saw Blades — MILFORD — Rezistor & Duplex Hack Saw Blades

SOLD THROUGH SELECT INDUSTRIAL DISTRIBUTORS

HYDROPTIC PERFORMANCE *makes tough jobs easy*



74-spindle multiple drilling machine head plate. Hole sizes range from 7/16" to 3" diameter.

Combination of hydraulically operated table and a built-in optical measuring system (the exclusive HYDROPTIC feature) assured the boring and drilling of these 230 holes with center distances held easily to .0005" *on each and every hole.*

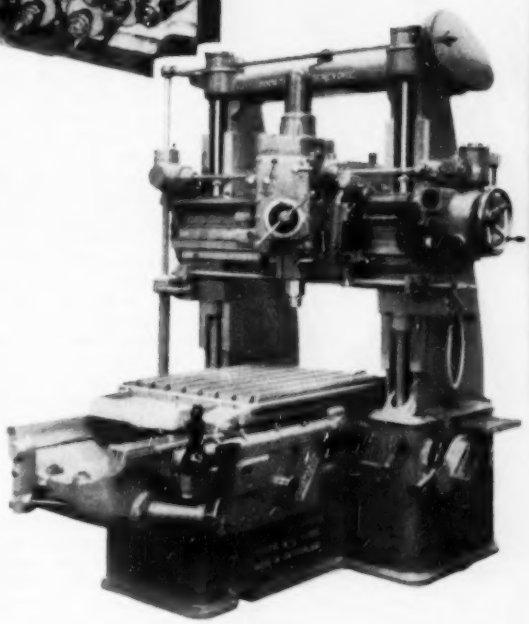
SIP HYDROPTIC B...

tops in precision . . . maintained trouble-free performance . . . versatility

SIP . . . and only SIP . . . offers you the proved spectacular accuracy achieved by use of the built-in Standard Scale and Micrometer and Microscopes reading to .0001".

Difficult jobs are accurately and easily machined . . . double checking eliminated.

These are two of this *precision machine's* many outstanding advantages. Ask us to give you all the reasons why the HYDROPTIC B . . . and all other machines in the quality-built, performance-proved SIP line . . . give you brand new standards of machine tool performance.



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Use Headed and Threaded Fasteners for Economy and Reliability

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THE PLACE TO SOLVE YOUR BOLT PROBLEMS

account without opportunity, the understudy must remember that "he that climbs a ladder must begin at the first rung." The understudy who is shifted and rotated in a round of various jobs in the shop will, if he is alert and receptive in his quest for new ideas and experience, broaden his own capabilities for his future job as general foreman of the shop. Staying in one job too long may lead to staleness and lack of initiative and efficiency. The worker who is given the opportunity to improve his skill and experience becomes better for it.

Although the "alternate delegate" may be "hitching his wagon to a star" he should remember Ben Franklin's advice, "he that can have patience can have what he will."

Harry Kaufman
Philadelphia, Pa.

•

There are times when management cannot advance a good man—when the position is not ready, or when the man is not ready. In many cases, neither of these opportunities materializes because either the position or the man is not available.

A man who is anxious to better himself does not have the patience to wait for an opportunity to present itself but looks for an opportunity with another concern. If the man has the ability and experience to step up, he is using good judgment by leaving the company if it does not offer any advancement. The man who works for thirty years for a concern, before he is advanced, may have good experience at the time but lacks the vitality and youth necessary to carry out his new tasks.

Many men have the qualities to be good foremen or supervisors but their capacity stops there. Further advancement is not likely or limited. Most foremen who have been advanced were not necessarily supervisors who have been promoted but factory managers or superintendents who were employed as foremen until the advancement occurred.

If management promises a certain employee first chance at any new opening they are exercising bad judgment. In the first place, the employee might not have the qualities for the specific position or another employee might be better fitted and some ill-feeling will occur.

Should the man be promised a certain position, he might get old and gray as Al puts it, if the present man is not qualified to advance and vacate the position. The employee who is slated for advancement might rest on his laurels and take over the new job without enthusiasm. If he has no competition, he will not exert any more effort than is necessary to hold the position.

Frank J. Zarnowski
Rutherford, N. J.

•

"KICKBACKS"

In my estimation, kickbacks, bonuses, whatever they may be called are a valuable asset for any type of work. Not only do they give an ambitious worker a chance to pick up a few luxury items for his private life that his salary may not permit, but it has been proven time and time again that any firm operating on this basis saves time and money through the program. Why not give the worker something for his effort on the job? Some say that he was hired at a set salary or wage and he should do his best for that price. I have always found better results where the men could cash in on a little extra. It gives them a feeling of belonging to the firm, not just one of the cogs that make the wheel turn.

This practice works in production work, sales drives, etc. Why can it not operate efficiently in a toolroom? Al is thinking of perhaps the loss of accuracy in the face of forced speed. It isn't that the job is run through at a faster clip than should be exercised, but the fellows just naturally cut down on the amount of "incidental time" that they use. Also with the opportunity for a bonus payment, the heads-up employee always has an eye open for any improvements that may save time and materials. I would have no fear of having work ruined, or mistakes made due to the loss of skill learned through many years of experience. Most jobs in today's toolrooms do not employ men who are not capable of backing

"It's all right . . . I'm getting married right after work!"

Guard Against Atmospheric Hazards...

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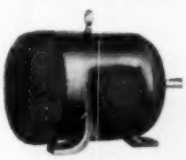
Drip Proof

Splash Proof

Totally Enclosed Fan Cooled



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Squirrel Cage Induction—1/6 to 400 H.P.
Wound Rotor Motors—1 to 400 H.P.
Synchronous Motors—20 to 150 H.P.

SINGLE PHASE

Split Phase Induction—1/6, 1/4, 1/3 H.P.
Capacitor—1/6 to 20 H.P.
Repulsion Start, Brush Lifting, Induction—1/2 to 20 H.P.

DIRECT CURRENT MOTORS

1/6 to 300 H.P.

GENERATORS

AC, .63 to 250 KVA
DC, .75 to 200 KW

GEAR MOTORS

1/8 to 1-1/2 H.P.

MOTOR GENERATOR SETS

AC to DC, AC to AC
DC to DC, DC to AC

Open Protected, Splash Proof, Totally Enclosed Fan Cooled, Explosion Proof.

Ball Bearing motors are factory lubricated for several years' normal service. Bearing housing construction permits easy re-lubrication when unusual service demands it.

To guard your production against the destructive effects of atmospheric hazards, Century offers four types of protective motor frames.

DRIP PROOF—meets the requirements of most installations. Use it where operating conditions are relatively clean and dry. Top half of the frame is enclosed to keep out falling solids and dripping liquids.

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TOTALLY ENCLOSED FAN COOLED—resists the hazards of abnormal concentrations of dusts, powders, grit, oil mists, acid and alkali fumes.

EXPLOSION PROOF—protects life and property in atmospheres charged with explosive dusts or vapors.

The properly selected protection with the wide variation of starting torque characteristics to choose from provides long operating life and improves the production of the driven equipment.

Century motors are available in a wide range of kinds and types—in sizes from ½ to 400 horsepower—for single phase, polyphase and direct current applications.

Specify Century motors for all your electric power requirements.

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Steel
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Hamilton, Super-Sensitive, Precision, Small Hole Tapping Machine. Price Complete $260.00

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If you have small, precision holes to drill or tap; and if this work must be done on fast production schedules; and if you can afford only a minimum of work spoilage and practically no breakage of taps or drills, then, sir, **you need a super-sensitive, precision, small hole drilling or tapping machine of Hamilton manufacture.** And you can get complete specifications and prices on the Hamilton line of four drills and a tapper from the bulletins which we have had printed especially to convey this information. They are free! Write for them today! You can use the information contained in these bulletins . . .

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Maxi-Jr., Super-Sensitive, Precision, Small Hole Drilling Machine. Price Complete $280.00

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up their talk with produced effort. The toolroom is no place for the fellow who cannot hold to required standards and set himself to work at a pace that is both honest to himself and his boss.

I do not believe in this practice when it is used as a tool to drive the men to higher production, at perhaps the eventual loss of their free time and the few minutes of bull session with the other men that is so necessary in shop work. The men need these few moments of companionship to better work with their neighbors and when a man becomes a driven tool, his first loss is his social contact with the others around him!

I would rather see it put on a basis of selection. The fellows are allowed to choose if they want to work for a bonus or not. After seeing some of the others make good on the project with no personal loss the balance of the gang will follow suit. I am also against working the men to the point of driving on nerves alone. I have seen this system worked, and believe me, it can't last for long. Either the men or the machines crack up, whichever is most in need of repair. Let's give our men in the shops a chance to prove their worth in the manner they choose to work.

Jack Bell
Bakersfield, Calif.

●

THOSE WHO have the enthusiasm to advance themselves in their line of endeavor will step to one side of traditional pace and methods to make themselves outstanding in their line of endeavor.

Likewise men as a rule appreciate an incentive and are willing to make an earnest effort to get it. This has been proved in many places when a piecework system has been established. The application of such an incentive on die work is unusual and more difficult to apply, as in most cases there is but one set required. However, the underlying principles for incentives are the same.

Such estimating would be difficult and would require the best of talent for this part in the plan as well as in selecting those who are to do the work, as there would be more chances taken on careful sizing by anyone except the best mechanics.

The plan looks feasible and although it might be rather slow in adoption, I believe it is practical and that kickback bonuses can be made attractive and should be profitable as well to all concerned if handled with careful consideration of all sides of the question.

H. B. Martin
Watervliet, N. Y.

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- Positioned Bearings
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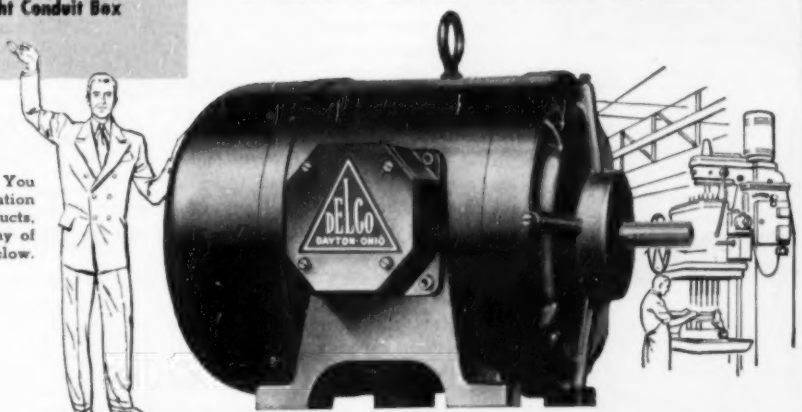
Get the Motor that Keeps Machines Rolling

It's on more and more spec sheets—those two important words, "DELCO PREFERRED." Because here's a motor built the way production men want motors built: sturdy, rugged, dependable. Just take a look at the *performance extras* that Delco Motors give you to eliminate machine down-time, cut down motor maintenance.



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DELCO MOTORS

DELCO PRODUCTS, DIVISION OF GENERAL MOTORS CORPORATION, DAYTON, OHIO

SALES OFFICES: CHICAGO • CINCINNATI • CLEVELAND • DETROIT • HARTFORD, CONN.

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FOR SMITH & MILLS

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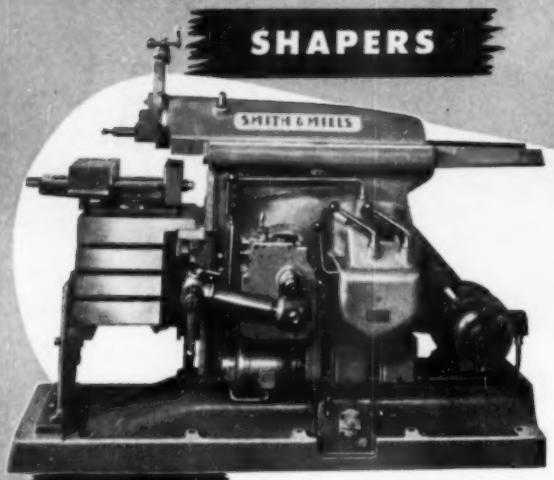
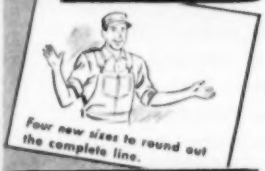
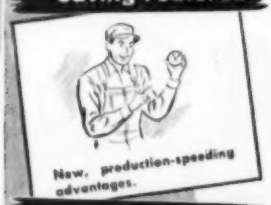


Added Sizes



Four new sizes to round out the complete line.

More Time-Saving Features



New, production-speeding advantages.

Greater Capacity

New Specials for shaping larger castings.

Added sizes, more money-saving advantages and greater job capacities now make Smith & Mills Shapers more versatile... give them sharply increased productivity.

Four new sizes, 20" and 24" Standard, and 14" and 36" Heavy Duty, have been added to round out the complete line.

New features cut setup and machining time sharply. Included are such advantages as horizontal and vertical power rapid traverse to the table; automatic tool lifter; tool head indexing unit; front hand feed, and automatic vertical feed to tool.

Two additional new models are now available for shaping larger castings. These are the 32" and 36" Specials, with greater capacity under the ram, and longer cross travel.

Write Dept. AM-5 for full details and your copy of catalog.

SMITH & MILLS SHAPERS, Inc.

DIVISION OF HAMILTON THOMAS CORP., HAMILTON, OHIO

Names in the News

(Continued from page 127)

Ray Fox has been named executive vice president and **A. L. Brosio** has been named vice president and general manager of National Steel & Shipbuilding Co., San Diego.

A. E. Conn has been named general purchasing agent, Ford Div., Ford Motor Co., Dearborn, Mich. **M. W. Welty** has been named industrial relations manager.

F. C. Norris has been named vice president and general manager of Denison Engineering Co., Columbus, Ohio. He was formerly vice president and general manager. **C. A. Hughes,** formerly plant supt., has been named vice president and general works manager.

Hollis H. Mosher has been named sales engineer for Illinois Tool Works, Chicago, working out of the Detroit sales office.

George Romney, assistant to the president, has been elected a vice president of Nash-Kelvinator Corp., Detroit. He was formerly managing director of the Automobile Manufacturers Assn.

Bernard Dolan, formerly manager of merchandising, Peter A. Frasse & Co., Inc., New York, has been named manager of sales.

K. F. Leaman has been named assistant division manager of Consolidated Vultee Corp's. San Diego division. He was formerly works manager there.

Charles I. Geddes has been named sales engineer for Rollins Engine Co., Nashua, N. H. Formerly manager, Robertson Tool Co. and recently chief engineer, A. S. Campbell Co., he will represent Rollins Engine throughout New England.

Delbert G. Faust has been named chief engineer, C. A. Norgren Co., Denver. He was with Walter F. Kidde Co., Bellville, N. J., for 14 years, the past ten as chief project and test engineer. For the past several months with Norgren, Mr. Faust has been engaged in coordinating Norgren engineering operations.

Gen. Brehon Somervell, president of Koppers Co., Inc., has also been named chairman of the board, following retirement of **J. P. Williams, Jr.** as chairman. **W. F. Munnikhuysen** was named executive vice president.

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Twenty illustrated pages show more than 40 different cutting tools, standard and special . . . and tell you the importance of what's *behind* the cutting tools you use.

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"HEADQUARTERS FOR ENGINEERED CUTTING TOOLS"

An ounce of prevention

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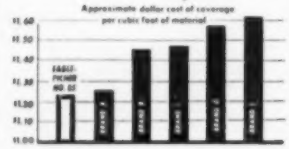
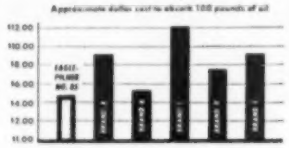
Eagle-Picher Industrial Floor Dry No. 85 is a granular mineral compound—chemically inert, non-combustible, and insoluble in oil, grease, kerosene or water. It can give you positive reduction in operating costs plus greater safety. Write for complete information.

Here's proof that Eagle-Picher Floor Dry No. 85 is tops in efficiency, economy

Comparative Coverage Costs



Comparative Absorption Costs



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Department AM-5-50
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Albert J. Berdis has been named assistant general superintendent of the Irvin Works of Carnegie-Illinois Steel Corp., Pittsburgh. **Albert T. Reichenbach** succeeds him as superintendent of the Vandergrift plant. **James D. Rollins** has been named assistant chief engineer of Carnegie-Illinois. **Norman C. Michels** has been named planning engineer to succeed Mr. Rollins and **Harry C. Hunter** as been named contract engineer.

Dr. Carl E. Swartz, division manager, Kellex Corp., New York, has been named chairman, Metals Research Dept., Armour Research Foundation of Illinois Institute of Technology. **Dr. William R. Osgood,** authority on the behavior of engine ring materials, has joined Armour as a research engineer.

George B. McMeans has been named works manager and **Edward J. Duffy** general superintendent of Kaiser Steel Corp. plant at Fontana; **Robert C. Madden,** former superintendent of the metallurgical dept. has been named division superintendent of rolling mills.

Kennedy Davidson, formerly vice president and treasurer of Consolidated Iron-Steel Mfg. Co., Cleveland, has been elected president, succeeding **I. T. Kahn,** who continues as chairman. Mr. Davidson remains as treasurer. **R. A. Godfrey,** former secretary, was elected executive vice president and secretary.

Walter E. Zimmerman, general manager of the Greer Steel Co. plant at Dover, Ohio, has been made a vice president and placed in complete charge of the company's Dover, Anderson, Ind., and Detroit operations. **Mrs. H. C. Greer,** acting president since her husband's death in 1948, was elected president, and **R. A. Reese** was renamed executive vice president.

Walter F. Mumford has been elected vice president in charge of operations, American Steel & Wire Co., succeeding **Harvey B. Jordan** who assumed the presidency Jan. 1.

Gloster P. Hevenor has been named executive vice president, Aquadyne Corp., New York. For 18 years prior to joining Aquadyne he was with Johnson-March Corp., of which company he was president from 1943 to 1948.

Henry D. Sarkis has been named sales representative by Clarostat Mfg. Co., Inc., Dover, N. H. He will cover metropolitan Chicago and Milwaukee areas, working out of the Chicago office.

F. F. Tiffany has been named division manager, Pittsburgh area, Reynolds Metals Co., Louisville, Ky. **T. D. Lewis** has been named division manager, Atlanta office.

Karl H. Keller has been named assistant to **E. M. Skipper,** vice president manufacturing, Locke Inc., Baltimore, Md. Mr. Keller went to Locke from Miller Co., Meriden, Conn., which he joined in 1946 as administrator of manufacturing and member of the management committee. There he was responsible for planning new plants, costs, methods, engineer and traffic. Previously, he was with the Glass Machinery Div., General Electric Co., in Cleveland; in 1934 moved to Cleveland Weld Works of GE, as factory engineer in charge of quality and in 1946 became executive engineer in the parts manufacturing division of the Lamp Dept of GE in Cleveland.

Arthur Grun has been named assistant superintendent of rolling mills at the Indian Harbor Works of Youngstown Sheet & Tube Co., Youngstown, Ohio. **John M. Stevenson** has joined Youngstown as a development engineer in its Mill Research and Development Dept.

Daniel Wardlaw has been elected vice president in charge of coated abrasive manufacturing, Mid-West Abrasive Co., Owosso, Mich.

Richard H. DeMott, vice president in charge of sales of SKF Industries, Inc., has been elected president of the Sales Managers' Assn. of Philadelphia.

Howard M. Boyd has been named sales manager for the Parts Div. of Sylvania Electric Products, Inc., Warren, Pa.

Albert E. Zeisel, formerly vice president and general sales manager of Eutectic Welding Alloys Corp., New York, announces that he is no longer with that company.

Hugh J. Ferry, president and treasurer of Packard Motor Car Co., has been elected treasurer and a director of Automobile Manufacturers Assn.

Cecil H. Gay, works manager of the Barberton plant of Babcock & Wilcox Co., New York, has been elected vice president.

J. R. Comber, former manager, Sales Order Div., has been named to head the Canton office of the Automotive Div., Timken Roller Bearing Co. **E. H. Hughes,** Systems Dept. manager, was named manager of the Sales Order Div.

Roger M. Kyes, general manager of the GMC Truck & Coach Div., has been elected a vice president of General Motors Corp.

Colby M. Chester has been elected chairman, Manning, Maxwell & Moore, Inc., Bridgeport, Conn. **Colby M. Chester III** was elected treasurer and **Miss E. Von Maur** was elected secretary and assistant treasurer. The new chairman succeeds the late **C. A. Moore. William J. Jarrett,** vice president and controller, has retired. He is succeeded by **John A. Flynn** as acting controller.

Thomas I. Crowell, Jr. and **Charles B. Cooke** have been elected vice presidents of Ford, Bacon & Davis, Inc., New York.

John F. Black has resigned as president and director of Circo Products Co., Cleveland. **Joseph W. Powell, Jr.,** vice president of American Research & Development Corp., Boston, was elected president. **Fenton M. Davison,** vice president, has been placed in charge of all company operations.

George A. Dauphinais has been named works manager, Quaker Rubber Corp., Philadelphia, a newly acquired division of H. K. Porter Co., Inc., Pittsburgh. He was plant manager at H. K. Porter.

J. Ralph Macon has joined Pennsylvania Salt Mfg. Co., Philadelphia, as an engineer in the Market Research Div. Formerly associated with duPont's Electrochemicals Dept., he will work on market development of new Pennsalt products for the metallurgical industry.

John H. Elliott has been named assistant general manager of operations, Carnegie-Illinois Steel Corp. **Arno L. Billeter** was named general superintendent of the company's Irvin Works, near Dravosburg, Pa., succeeding Mr. Elliott.

W. M. Hurley, former assistant works manager, has been named works manager of the East Alton plant of Olin Industries, Inc. He will direct manufacturing of the plant's large sporting ammunition, brass, and explosives divisions. As Western Cartridge Co. works manager, Mr. Hurley succeeds **B. E. Rogers,** recently named works manager, Winchester Repeating Arms Co., Div. of Olin Industries at New Haven, Conn. Western Brass Mills, another Olin division at East Alton, has announced a sales change in which sales operations for its two manufacturing divisions, Mill Products and Fabricating, will be combined. The territorial change divides eastern and western United States in two areas with the break at Cleveland. **Huntly M. Campbell,** formerly sales manager, Mill Products Div., now becomes sales manager of both Mill and Fabricating Products for the western division. **E. N. Rousseau,** who headed sales for Fabricating, is now sales manager of Mill and Fabricating Products in the eastern division.

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AUTOMATIC AIR FEED

FITS ANY PRESS—Front or side mount, or attaches to die. 2-bolt installation.

ACCURATE—Works to positive stops! No slippage!

SIMPLE SET-UPS—Change in a few moments! No special cams, no wasted time! Changes are so easy and quick you can now feed short runs as well as long runs automatically—increase both your profits and available press time!

VERSATILE—Handles any stock, any thickness. Foils, strips, rounds, squares, etc! Feeds singly or two or more at a time!

ECONOMICAL—Costs ⅓ to ¼ as much as other feeds of similar capacity or range!

FEEDMASTER will solve your automatic feeding problems! Nothing else like it! The simplest, most efficient, most time-saving automatic feed on the market! No rolls, no gears, no springs . . . requires no power from press! GET ALL THE FACTS. Write for detailed literature, sizes, prices!

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Editor Emeritus, "American Machinist"
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Gives you practical information on:

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How *you* can start a small machine shop

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You get practical pointers on locating and laying out your shop, selecting equipment, handling jobs efficiently, improvising cost-saving parts, and many more everyday problems.

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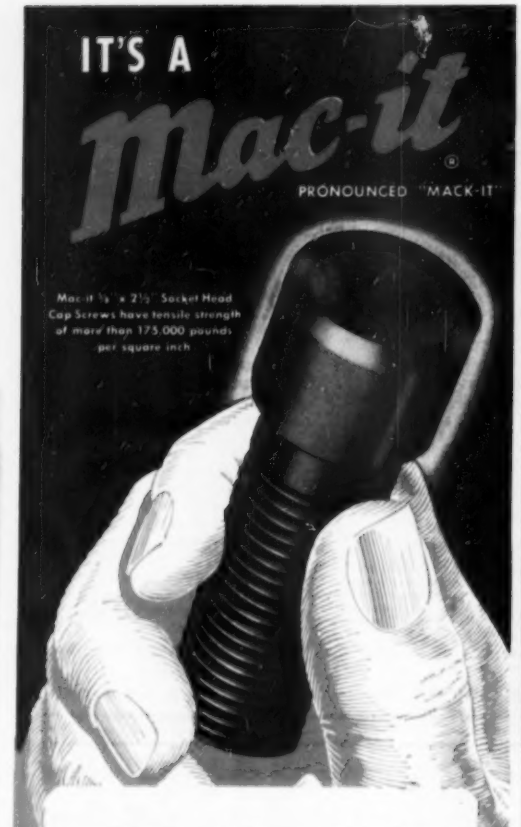
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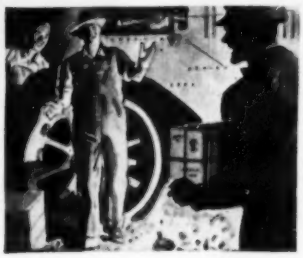

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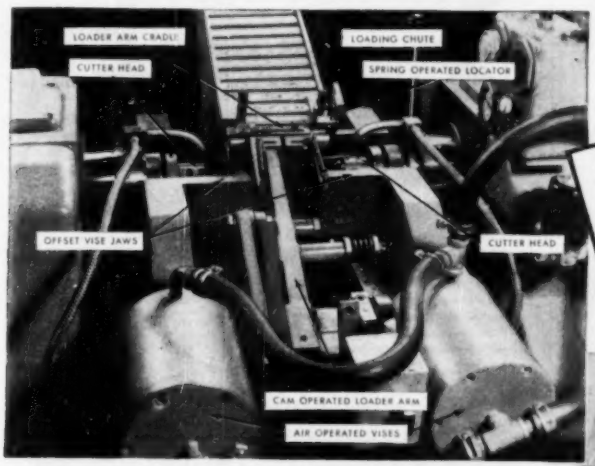

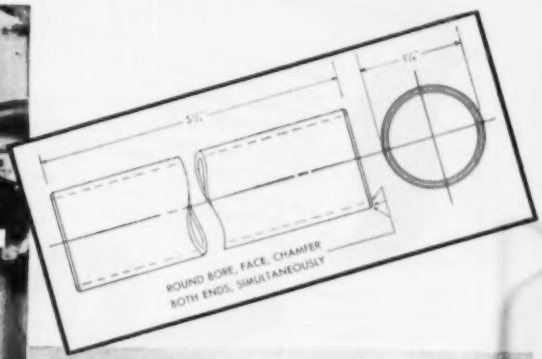

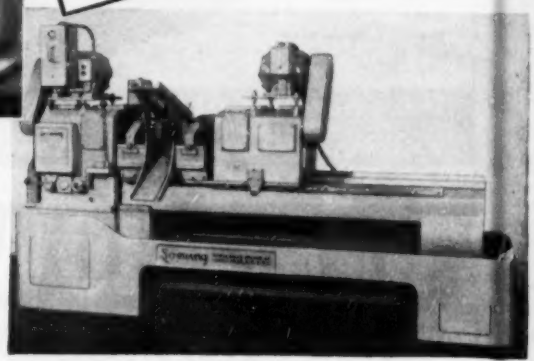

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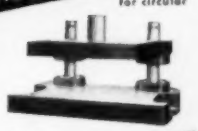

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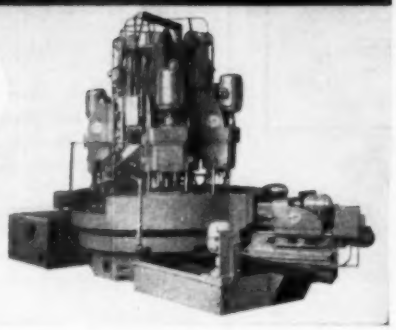

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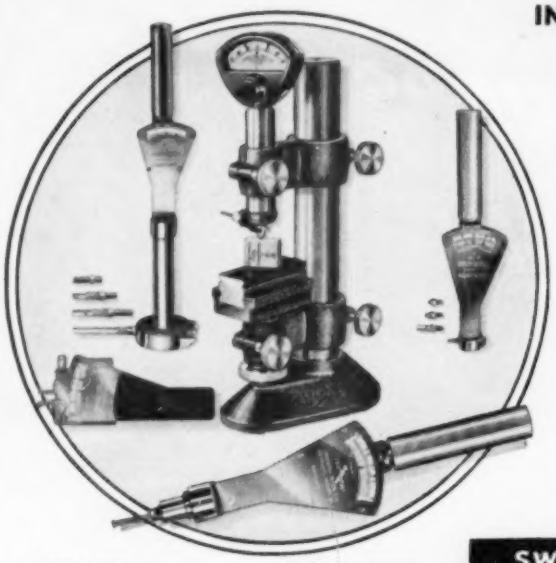

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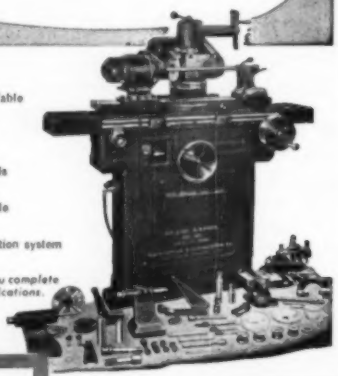

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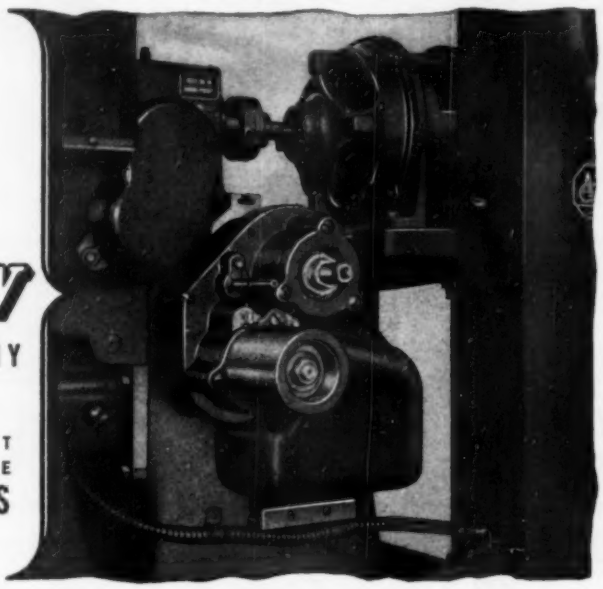

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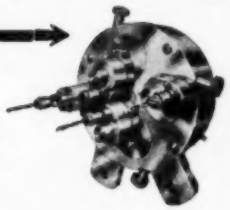

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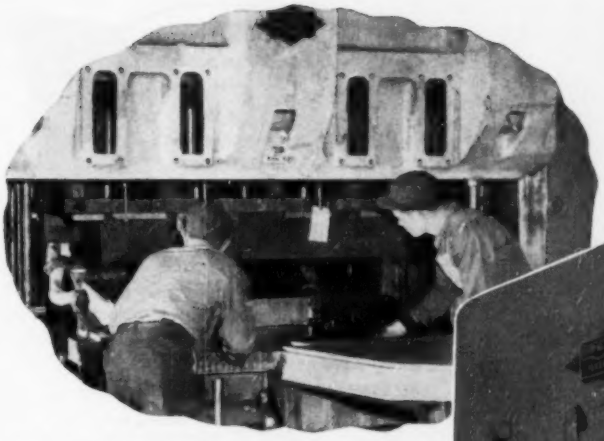

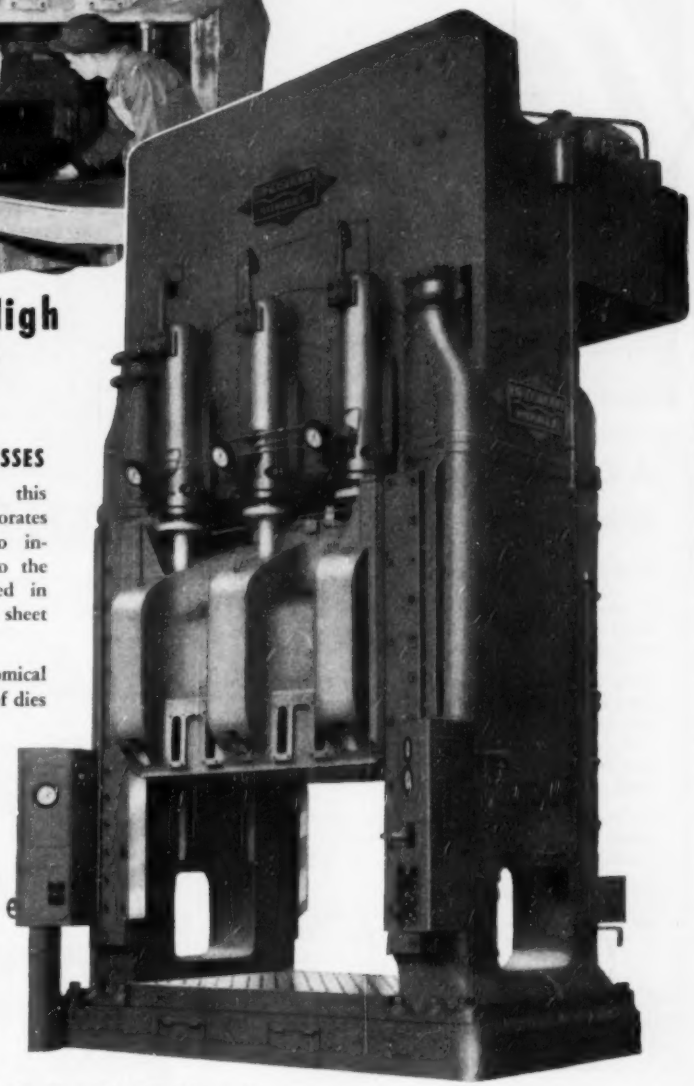

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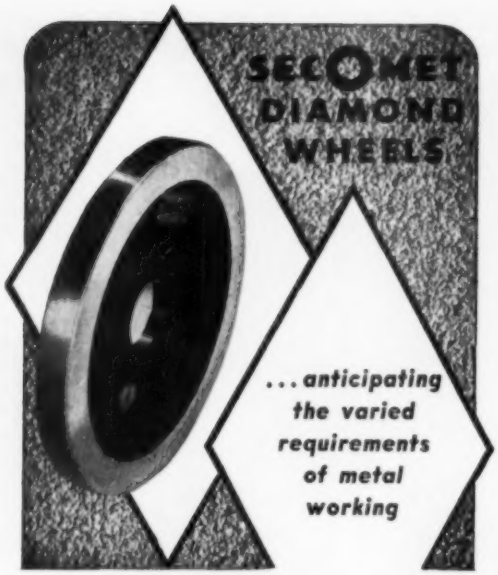

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- Rust prevention
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OAKITE SPECIALIZED INDUSTRIAL CLEANING MATERIALS • METHODS • SERVICE

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SACKMAN ADJUSTABLE SWING TOOL HOLDER

(Trade Mark)

HOLDS RIGID! NO CHATTER!

A new, adjustable tool holder of revolutionary design:

- Solves difficult problems by holding wide form tools or carbide tools rigid with complete absence of chatter.
- Adjustable posts allow variety of tool sizes.
- Two tools held at one time in this unique swing tool holder.
- Provides high speed production.

Inquiries from distributors invited

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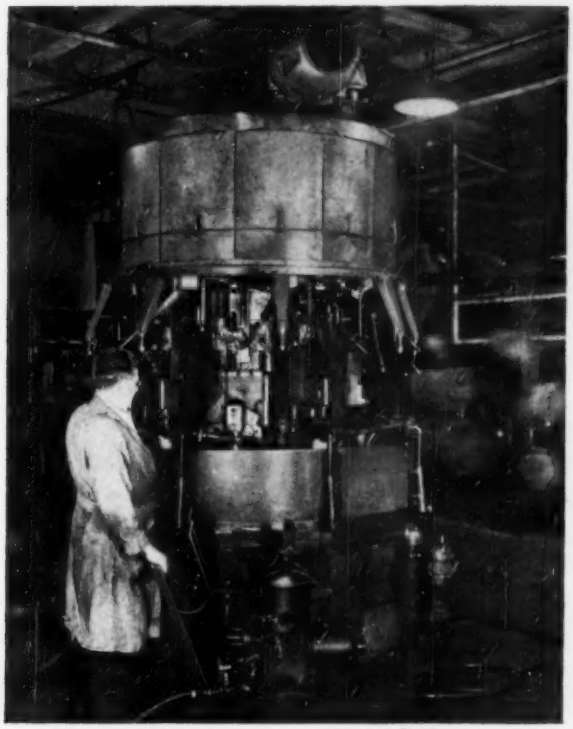

THIS "DAVID" *protects* "GOLIATH"

This De Laval Oil Purifier — small in relation to the size of the Bullard "Mult-Au-Matic" — safeguards the giant machine tool at this wheel plant. It is a portable unit, moved each day to another Bullard. Up and down the production line it goes, removing contaminants from the hydraulic oil by means of centrifugal force.

This is another specific example of how De Laval machines can safeguard machine tool performance by insuring the purity of the lubricating oil or hydraulic oil. Wholly mechanical in action, they are more rapid and more effective than any other means of purifying oil.

Many other applications for De Laval Oil Purifiers are to be found in nearly every metal-working plant. Bulletin MM-1 lists them — write for your copy.

THE DE LAVAL SEPARATOR COMPANY
165 Broadway, New York 6 427 Randolph St., Chicago 6
DE LAVAL PACIFIC CO., 61 Beale St., San Francisco 5
THE DE LAVAL COMPANY, Limited, Peterborough, Ont.

De Laval PURIFIERS and CLARIFIERS FOR FACTORY OILS

for greater operating efficiency

New
Meet Military Standards For Surface Quality with Surface Finish Standards

by the use of certain instruments designed for the purpose, at present, for general use, the most practicable method available for determining roughness is the use of calibrated surface roughness comparator blocks or specimens. Comparator blocks are procurable in sets consisting of a number of blocks corresponding in surface

Reprinted from MIL—STD—10; 2 August 1949 "This standard is mandatory for use effective 2 January 1950 by the Departments of the Army, the Navy and the Air Force. Deviations from this standard will be permissible only by authority of the Munitions Board Standards Agency."

Like progressive manufacturers everywhere, Army and Navy Ordnance Plants now have Surface Quality Control Systems to assure complete understanding between Engineering, Production, Inspection, and Purchasing as to surfaces required on every part. Machine-cut SURFACE FINISH STANDARDS are the easy, economical, and positive means of carrying out such systems. With these comparator blocks you can control surface quality at a fingernail-touch and reduce production costs by specifying fine finishes only on surfaces that need them.

If you are doing Government work, if you are interested in producing better products at lower costs, you should be controlling surface quality with machine-cut SURFACE FINISH STANDARDS. Specimens are clearly marked in micro-inches and cover all ordinary machine operations. Available in Pocket-Size Sets of 20 stainless steel specimens or Master Sets of 23 specimens.

The Master Set of SURFACE FINISH STANDARDS includes specimens from 2 mu (micro-inches) polish to 500 mu turn. All specimens have machine-cut surfaces of predetermined roughness value.

Learn "Why Surface Quality Control Pays" Write today for Bulletin No. 1049A

EDWARD Blake COMPANY

437 Cherry St., West Newton 65, MASSACHUSETTS

Black Diamond Precision Drill Grinders . . . Blake Tap Chamfer Grinders . . . Blake Flute Grinders . . . Waltham Cutter Sharpeners . . . Waltham Thread Milling Machines . . . American Tool Holders . . . Surface Finish Standards.

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THE POSSIBILITIES OF THE NATIONAL KEYSEATING MILLER on Your Work

• Shops all over the country are solving difficult keyseating problems by chucking this attachment on their drill presses, radials and horizontal boring mills — and milling keyseats in pieces too large or bulky for convenient handling on keyseating machines.

The "National" goes through the hole once and mills keyseats with parallel sides and parallel with the axis of the bore. It's a big time and money saver and is available in standard stock diameters from ½" to 3½" for cutting lengths from 1⅞" to 12". It will keyseat in blind holes, and offset holes. We also manufacture oil-grooving millers.

Several widths of cutters can be used with each size miller and many different hole diameters keyseated with one tool through the use of eccentric bushings.

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ACCURACY
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These three factors are the key-note of our special tools and machinery. Columbus Die-Tool builds and designs the tool for your particular purpose and will solve the toughest tooling problems effectively and promptly. Do not hesitate to consult us, our experience in this field is most comprehensive.

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BUILDING COMPLETE MACHINE TOOLS
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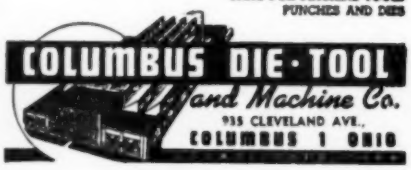

The Completely NEW 1218 Hydrabrasive SURFACE GRINDER

WHAT IT IS . . .

The NEW 1218 Hydrabrasive Surface Grinder is another exclusive development by Abrasive. Ruggedly built on a deep, massive base . . . hydraulically operated . . . it answers the universal need for *wide cross travel* with *moderate table length.*

WHAT IT MEANS TO YOU . . .

MORE POWER!

Super-powered by a fan-cooled, totally enclosed *3 HP* Spindle Motor driving a 12" wheel, it assures you of *PLUS* cutting capacity for crush grinding on the one extreme to conventional grinding on the other.

MORE SPEED!

A wide range of adjustable *table speeds* from ½ foot per minute to 90 feet per minute with ⅛" of *cross* feed movement in 1/10 of a second! In addition, the table speed reduces from 90 feet per minute to 0" in only 1" of run-over beyond the work . . . an appreciable saving in grinding time.

MORE DOLLAR VALUE!

Abrasive's use of *Saddle Ball Ways* is particularly significant to manufacturers of gauges, dies, and fine instruments . . . wherever precision transverse adjustment is required.

No longer is it necessary for you to go to the additional expense of extra table length to obtain wide cross travel . . . for the NEW 1218 Hydrabrasive gives you *MORE* for *LESS* by delivering greater dollar value per cubic inch of work capacity.

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Abrasive Quality is Reflected in the Finish of Your Product

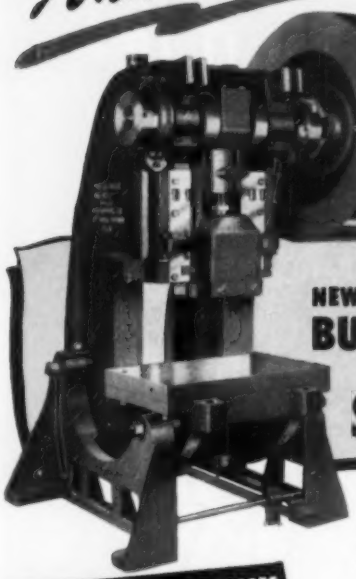
ABRASIVE

ACCURACY BOOSTS PRODUCTION

Announcing

THE NEW PRESS-RITE 85 TON POWER PRESS

OPEN BACK • INCLINABLE



Featuring...

NEW FRAME DESIGN* WITH BUILT IN TIE RODS FOR GREATER STRENGTH

*NOW..a completely new one piece gap frame, with two tie rods built in give you extra strength, rigidity and insured extra tonnage at NO EXTRA COST. EXCLUSIVE on Press Rite Power Presses.

DON'T DELAY...This Press was recently shown at the ASTE EXPOSITION!

PRESS-RITE POWER PRESSES ARE BUILT IN SIZES FROM 5 TO 85 TON!

...WRITE FOR COMPLETE DETAILS NOW!

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of busy men in industry find it a time-saving habit to use the . . .

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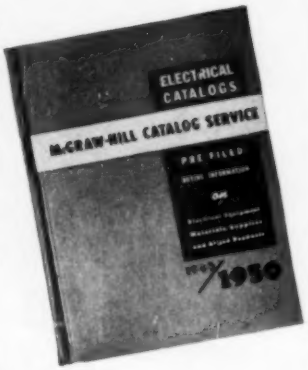

when they want the answers to these buying questions about electrical products:

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Who makes the product best suited to my needs?
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If the Pre-Filed ELECTRICAL CATALOGS are not available for buying reference at your plant, write to:

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There is no charge to qualified users.

From The *American Machinist* Library of *Tips for Top Shop Men*

KEEP your opinions of subordinates to yourself—or tell them directly. Don't broadcast your opinions to their fellows, unless you have the rare case in which your opinion, repeated by others, is more effective than your direct statement.

KEEP your critical eye on time-hallowed systems. Times and needs change, and you may find some parts of your systems in need of drastic revision.

A Snap Gage that is way out in front and at a price that is right

For years you've seen snap gages — both with and without Indicators — that really do *not* answer your needs. You've wanted a simple gage that was foolproof, rugged, and easy to handle — *and at a right price.* Here it is: Federal Model 1000! All our research, all our know-how in gage-making, all your wants, likes and dislikes, your demands and your gripes have been carefully considered to make this an outstanding Gage. Model 1000 is "IT", the right gage at the right price.

There are no tricky gadgets — Model 1000 is simple, easy to set and easy to use. It's rugged and fully guarded to withstand the roughest handling. It feels and handles like an old fashioned conventional gage but it's years ahead in design and performance. Model 1000 is completely new and up-to-date in every detail . . . newer even than any other Indicating Snap Gage.

Model 1000 has everything — visibility, positiveness, simplicity, lightness, toughness — it's dead to temperature changes and above all *accurate.* You'll like it when you see it and you'll like it more when you use it.

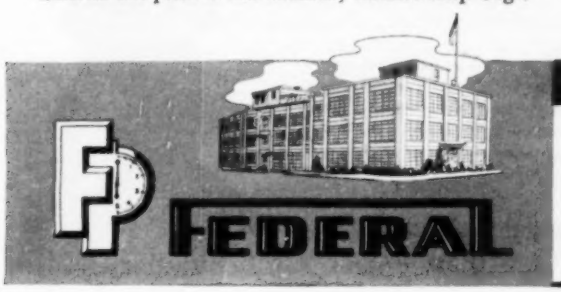
No other Indicating Snap Gage can match Model 1000 in usefulness. Five sizes cover the full range from 0 to 6". Think of the number of old-style conventional gages each Model 1000 can replace — think of the savings, too!

Federal Model 1000 All-Purpose Snap Gage does a *better* job at less cost. Its price will surprise and please you. Send coupon attached to your letterhead for complete descriptive bulletin and price of this definitely modern Snap Gage.

MODEL 1000 SERIES

$57.50 ANY ONE SIZE with .0005" Dial Indicator

$75.00 ANY ONE SIZE with .0001" Dial Indicator



SEND THIS COUPON TODAY

FEDERAL PRODUCTS CORP.
1125 Eddy St., Providence 1, R. I.
Please send me complete information on the new Model 1000 Series Snap Gage:

Name ..... Title .....

Company .....

Address .....

CARLTON RADIAL DRILL

FEATURES: 1. Low Hung Drive to Spindle. 2. All Power Driven Parts Running in Oil. 3. Quiet Running at all Speeds. 4. Concentrated and Convenient Push-button Controls. 5. Constructed on Unit Principle.

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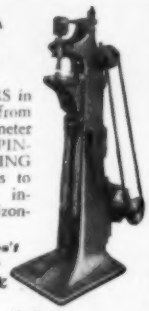
CINCINNATI 25, OHIO, U. S. A.

GRANT



RIVETERS — PIONEERS in their line—head rivets from smallest to ¾" diameter either by NOISELESS SPINNING or VIBRATING HAMMER method—Sizes to meet all needs—Types include Vertical and Horizontal Multiple Spindles.

Write for literature and don't forget to send samples.

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FOR SMALL
JIG BORING
PUT SMALL JOBS ON THIS
LINLEY MACHINE

and save your larger machines for heavier work.

YOU'LL BE SURPRISED!

at the extremely low first cost and the vitally important jobs that this little precision machine can do. It will pay you to get our accuracy information on this machine which has 6" x 10" table movement and 7" x 17½" table size.

Write TODAY For Full Information

LINLEY BROTHERS COMPANY
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BUZZER *Gas Fired* POT FURNACES

UP TO 1650° F. QUICKLY ATTAINABLE. NO BLOWER OR POWER NECESSARY . . . JUST CONNECT TO YOUR GAS SUPPLY.

Almospheric Pot Hardening Furnace, tangentially fired, assures quick, even heat. Many models available — write for "BUZZER" catalog showing Gas Furnaces, Burners, and other equipment.

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"ROCKWELL" HARDNESS TESTER
Made Only by Wilson

● Development and improvement of "ROCKWELL" Hardness Testers over the years have made "ROCKWELL" scales the universal standard of hardness. A reading on the "ROCKWELL," the "ROCKWELL" Superficial or the "TUKON" Tester is the same in any language.

WILSON MECHANICAL INSTRUMENT CO., INC. **ACCO**
AN ASSOCIATE COMPANY OF AMERICAN CHAIN & CABLE
230-8 PARK AVENUE, NEW YORK 17, N. Y.

WALTHAM SUB-PRESSES...
. . . for precision work

Arch Sub-Press

The cylindrical plungers in the Waltham Sub-presses slide in babbitted bearings. This bearing is tapered on the outside and can be forced downwards, thus reducing the inside diameter to fit the plunger when the latter becomes worn through use. Exact alignment and constant precision can be maintained throughout the life of the die. Write for information about the nine sizes.

Overhang Sub-Press

WALTHAM MACHINE WORKS
HIGH STREET, WALTHAM, MASS.

YOU MIGHT DOUBLE OUTPUT AND CUT COSTS IN HALF. One company was grinding 1.3152" O. D. x 11/16" bearing races at a rate of 300 per 8-hour shift on two old-style internal grinders—one for roughing and one for finishing. Two operators were required.

They found that handling time between the two operations was the most time-consuming element in the machine cycle. They proved that reduction of grinding time alone was not the best way to reduce floor-to-floor time.

Two new No. 1216 Bryant Internal Grinders are now producing 675 of these bearings per 8-hour shift, because each machine not only grinds faster, but roughs and finishes in an automatic cycle, and *eliminates the rehandling and rechucking of each part.* A single operator easily attends both machines. The tolerance for hole size is plus .0005 inch, minus .0000 inch, and, although taper must be held to .0003 inch, the Bryants consistently hold this tolerance to .0001 inch. Surface finish is about 8 micro inches.

It won't cost to check production of your machines against estimated production of new machines.

Bryant Chucking Grinder Company is prepared to give you accurate figures on production and costs so that your management can translate them into terms of investment. Send your present production figures to Bryant now. We will give you data which may help you buy that much needed machine.

Remember—it won't cost to inquire.

BRYANT

CHUCKING GRINDER CO.

SPRINGFIELD, VERMONT, U.S.A.

THIS MAN WOULDN'T NEGLECT

A MACHINE IN HIS PLANT

...yet he hasn't had a Chest X-Ray!

He checks every piece of mechanical equipment he owns for wear, lubrication, efficiency.

Yet he fails to take the simple precaution of a Chest X-Ray to make sure he does not have tuberculosis. *Not because he's opposed to the X-Ray. Simply because he is not sufficiently informed—or just hasn't taken the time and trouble, or does not realize the seriousness of the problem.*

A Chest X-Ray is the first step toward detecting tuberculosis in its early stages. And in its early stages it can be cured with the least loss of time from work.

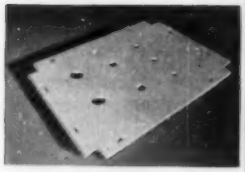
So, if you're the man above, that one simple reason should make you get your Chest X-Ray—*today*. But listen, see how serious this really is:

Between the ages of 15 and 34, tuberculosis leads all other diseases as a cause of death—although at no age are you safe from TB. Yet, if everyone does his part by getting a Chest X-Ray periodically, and the majority of cases thus discovered are followed up, we can eliminate TB entirely as a public health hazard!

Will you do your part today? Get a Chest X-Ray. It may mean your life!

Published in the public interest by:

McGRAW-HILL PUBLICATIONS



The first **radio chassis,** 10"x 14", with 27 holes and 4 notches shown above was produced including setup in only 9.3 minutes and subsequent pieces in only . . . **1.8 min.**

A part of a piece of **farm equipment,** 72½"x 22", with 32 holes and nibbled cut-out was finished including setup in only 12.01 minutes, subsequent pieces in **2.3? min.**

Above circle, 24" in diameter with OD nibbled and 5 holes punched was produced in only 4.26 minutes including setup and subsequent pieces in only **2.38 min.**

An **electric refrigerator** part, 39⅜"x 8½" with 10 holes and 4 notches was fabricated including setup in only 5.61 minutes and subsequent pieces in only . . . . . **37 sec.**

An **automotive** channel, 28" long with 12 holes was fabricated including setup in only 3.37 minutes and subsequent pieces in only **29 sec.**

Can you match these WALES FABRICATOR TIME STUDIES *with your present methods?*

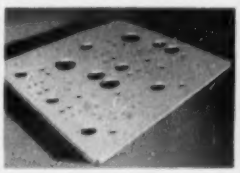
● These time studies were made under actual production conditions with average operators and were taken at random from hundreds of time studied parts.

There is nothing like this revolutionary Wales Fabricator. It punches, notches and nibbles. Wales exclusive Hydra-New-Matic Drive is unique in its simplicity of design and operation...so unique, in fact, that vibration and noise is practically eliminated at 165 strokes a minute. This drive plus the Wales patented "Quick-Change" system makes possible these startling "never-heard-of-before" time study figures.

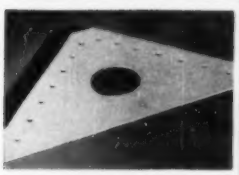
IT'S TOO BIG A STORY TO TELL ON THIS PAGE, so write for fully-illustrated, functionally-colored Catalog 10-A and discover for yourself why production schedules of this Fabricator have been more than doubled.

●

WALES-STRIPPIT CORP.
George F. Wales, Chairman
373 PAYNE AVENUE
North Tonawanda, N.Y.
(Between Buffalo and Niagara Falls)
WALES-STRIPPIT OF CANADA LTD. HAMILTON, ONTARIO
Specialists in Punching and Notching Equipment

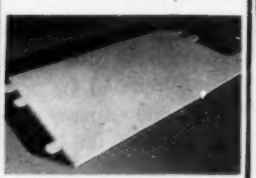


Above **electronic chassis,** 12½"x 11½", with 118 holes and 4 notches was completed including setup in only 32.45 minutes and subsequent pieces in only **6.44 min.**



An **aircraft** gusset plate 7½"x 4½" with 15 holes and 1 notch was produced including setup in only 3.52 minutes and subsequent pieces in only . . . . . **54 sec.**

A piece of work, 11¼"x 24", with 9 holes and 4 notched, rounded corners was produced including setup in only 4.99 minutes and subsequent pieces in only **41 sec.**



The above piece of work, 22¼"x 9½" with 4 holes and 2 sides notched and nibbled including setup was produced in only 6.10 minutes and subsequent pieces in only **1.2 min.**

Precision Die Made—Lowest Possible Cost.

DAYTON ROGERS MFG. CO., Minneapolis 7, Minnesota

Die-Making Machines

They save 50% on sawing, filing and lapping operations, easily maintaining .002" limits. Ask for special bulletin—also circulars on Drill Grinders, Point Thinners, Tool and Cutter Grinders, Face Mill Grinders and Tool Bit Grinders.

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Oliver Instrument Co., 1414 Maumee St., Adrian, Mich.

D. A. Stuart Oil Co.

STUART *service goes with every barrel*

HOLMAN BETTER, FASTER HOLE FINISHING

HELICAL TAPER PIN REAMERS

Scientifically made of selected steel under modern processes. Long lived, economical, accurate. Details on request.

HOLMAN REAMER CO.
MANCHESTER, CONN.

GIVE TO CONQUER CANCER

These advertisements

are current, live opportunities in the metal-working field.

Each advertisement represents a current Want or Offering of an organization or individual in the field, with some element of profit in each for whoever can fill the need. Some have money-saving possibilities, others are opportunities for more business; many are employment opportunities; still others offer property, or equipment—used or surplus new equipment.

"Searchlight" advertisements are constantly changing. New opportunities are constantly finding their way into this great Want medium each issue. Regular consultation of the "Searchlight" pages can be as important to you as reading the text pages of each issue; Text matter is news of the industry; Advertising is NEWS OF OPPORTUNITIES offered in the industry.

for EVERY business WANT

"Think SEARCHLIGHT first"

SEARCHLIGHT SECTION

EMPLOYMENT • BUSINESS • OPPORTUNITIES • EQUIPMENT—USED or RESALE

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90¢ per line, minimum 4 lines. To figure advance payment count 5 average words as a line.

POSITIONS WANTED (full or part-time individual salaried employment only). ½ above rates.

PROPOSALS, 90 cents a line an insertion.

INFORMATION

BOX NUMBERS in care of any of our New York, Chicago or San Francisco offices count 1 line additional in undisplayed ads.

DISCOUNT of 10% if full payment is made in advance for four consecutive insertions of undisplayed ads (not including proposals).

DISPLAYED RATE

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AN ADVERTISING INCH is measured ⅞ inch vertically on one column, 3 columns—30 inches to a page. A.M.

NEW ADVERTISING received by 10 A.M. May 26th will appear in the issue of June 12th subject to limitation of space available

REPLIES (Box No.):
Address to office nearest you
NEW YORK: 330 W. 42 St. (18)
CHICAGO: 520 N. Michigan Ave. (11)
SAN FRANCISCO: 68 Post St. (4)

POSITIONS VACANT

ESTIMATOR FOR Jobbing Machine Shop. Must be experienced on variety of work from small parts to large special machinery. Must be well acquainted with latest machine shop practice and have good background and experience in similar position. Standard Tool and Manufacturing Company, 237 Laurel Ave., Arlington, New Jersey.

TOOL ROOM Foreman—Excellent salary for qualified man. To take charge of modern tool room employing six men. Work includes dies, plastic molds, tools, jigs, fixtures, models and experimental machines. Should be about 35 years old with at least 10 years actual experience in this line of work. Steady habits, ability to directly and efficiently supervise are essential. Good working and living conditions in southern Minnesota city approximately 30,000 population. State full employment record and experience in detail in first letter. Also furnish photograph. All replies strictly confidential. Write to P-6510, American Machinist.

MACHINE TOOL Designer wanted by nationally known Cincinnati, Ohio machine tool manufacturer. Give age, education, experience and salary expected. Apply P-6683, American Machinist.

SELLING OPPORTUNITIES OFFERED

MACHINE TOOL Salesman, experience necessary, prefer young man having practical machine shop, designing and engineering experience. Excellent opportunity in New York Eastern territory. Write details to SW-6546, American Machinist.

UNUSUAL OPPORTUNITY for machine tool salesmen. Manufacturer's agencies or independent salesmen can profit substantially with our popular tool and equipment line. Favored by mechanics wherever sold. Large reorders. Well cataloged. Several exclusive territories open. RW-6693, American Machinist.

WANTED

WANTED

One 10 ft. 10 ga. squaring shear with hydraulic hold-down dogs. Must be late model.

HOUSTON SPECIALTY MANUFACTURING CO.
3016 POLK AVE. HOUSTON 3, TEXAS

WANTED
BULLARD MULT-AU-MATICS

Type "D" 16" 6-spindle Type "D" 8" 6-spindle
Type "D" 12" 6-spindle Type "A" 12" 6-spindle

ADDRESS FULL DETAILS TO
W-6653, AMERICAN MACHINIST
330 W. 42 St., New York 18, N. Y.

EMPLOYMENT SERVICE

SALARIED POSITIONS $3,500-$35,000. If you are considering a new connection communicate with the undersigned. We offer the original personal employment service. 40 years recognized standing and reputation. The procedure of highest ethical standards is individualized to your personal requirements and develops overtures without initiative on your part. Your identity covered and present position protected. Send only name and address for details. R. W. Bixby, Inc., 266 Dun Bldg., Buffalo 2, N. Y.

POSITION WANTED

EXECUTIVE ENGINEER desires connection with medium size company. Qualified to assume full responsibility as Plant Manager, Superintendent, Chief Engineer or Staff Assistant, 25 years of practical, design, manufacturing and sales experience in the field of automatic machinery, instruments, tools and fixtures, precision gears, refrigeration and metal stampings. Development of new products, purchasing, assembly, inspection, cost control, budget planning, plain engineering, labor relations. Capable organizer and negotiator with excellent record to get things done. Age 47, College Graduate, M.E. PW-6640, American Machinist.

PATENT ATTORNEY

Patent Practice

before U.S. Patent Office, Validity and infringement investigations and opinions. Booklet and form "Evidence of Conception" forwarded upon request. Lancaster, Allwine and Rommel, Registered Patent Attorneys, Suite 455, 815-15th Street, N.W., Washington 5, D.C.

LATE MODEL TOOLS

No. 2D KEARNEY & TRECKER Rotary Head Tool & Die Miller.

No. 22VS REED PRENTICE Vertical Miller & Die Sinker. 1948.

No. 2BL NATCO "Kolesteel" Multiple Spindle Drill, rectangular head.

10"x20" MONARCH Model "EE" Toolroom Lathe.

14" x 30" LoBLOND Engine Lathe.

12"x30" MONARCH Model "KK" Engine Lathe.

WIGGLESWORTH MACHINERY COMPANY
203 Bent Street, Cambridge, Mass.

FOR SALE

Threading Machine ⅝" Single Head Landis Turret Lathe. South Bend 2 H—1⅝" spindle Turret Lathe. Simmons #3—1¼" spindle.

All motor driven, excellent shape, used very little.

J. W. PITT, INC. BATH, N. Y.

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KAMIS ENGINEERING COMPANY

DESIGNERS & MANUFACTURERS OF

TOOLS AND MACHINERY

WE HAVE OPEN CAPACITY FOR MACHINE WORK ON THE FOLLOWING FACILITIES:

36" to 54" Vertical Boring Mills
3" to 5" Horizontal Boring Mills
#2 to #5 Vertical and Horizontal Millers
10" to 50" Engine Lathes

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MATCH PLATE WORK A SPECIALTY
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IN PRACTICALLY NEW CONDITION

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36"x36"x14' Cincinnati Hypro, 2 rail heads, 2 side heads, latest

36"x36"x16' Cincinnati Hypro, 2 rail heads, 2 side heads, latest

48"x48"x22' Cincinnati Hypro, 2 rail heads, 2 side heads, latest

72"x62"x20' Cincinnati Hypro, 2 rail heads, 2 side heads, latest

72"x48"x22' Cincinnati Electronic Planer Type Mill, 4—6¼" quills, 25 H.P. each head, latest

PLAIN CYLINDRICAL GRINDERS

10"x48" Norton, m.d., latest

No. 5—3x18" Brown & Sharpe, m.d., latest

6x18" Norton Type C Hydraulic, m.d., latest

RADIAL DRILLS

3'-9" Cincinnati-Bickford, m.d., late type

3'-9" Morris, m.d. on arm, latest

4'-9" Cincinnati-Bickford, m.d., latest

5'-11" Carlton, m.d. on arm, latest

6'-1½" American Hole Wizard, m.d. on arm, latest

BORING MILLS

3½" Cincinnati-Gilbert Horizontal Floor Type, m.d.

No. 25T Giddings & Lewis Horizontal, m.d., 2½" bar, latest

100" Niles Extra Heavy Vertical, m.d., p.r.t., late

CENTERLESS GRINDERS

No. 2 Cincinnati, m.d., Filmatic Spindle, latest

No. 3 Cincinnati, m.d., Filmatic Spindle, latest

UNIVERSAL GRINDERS

12x48" Cincinnati Hydraulic, m.d., latest type

12x48" Norton, m.d., latest

18x48" Cincinnati Hydraulic, m.d., latest

SURFACE GRINDERS

No. 2 Brown & Sharpe, m.d. in base, late type

Hanchett Horizontal Spindle Plano Type, model OS, m.d., latest

No. 25A—24" Heald Rotary, m.d., latest

10x12x60" Norton Hydraulic Surface, m.d., latest

Type C 16x20x48" Thompson, m.d., latest

MANUFACTURING LATHES

No. 3 Lodge & Shipley Duomatic, latest

ENGINE LATHES

10x20" centers Monarch EE Geared Head, m.d., latest

14x30" Lodge & Shipley Selec. Head, m.d., latest

14"x54" centers Lodge & Shipley, m.d., latest

14"x102" centers LeBlond, m.d. in leg, latest

10"x30" Reed Prentice, m.d., latest

32"x12' Lehmann Hydratrol Geared Head, m.d., taper, latest

36"x36'6" Niles Heavy Duty, m.d., latest, 2 carriages

MILLING MACHINES

No. 2-13 Cincinnati Mfg., m.d., with rise and fall, latest

No. 2-24 Cincinnati Mfg., m.d., latest

No. 4-48 Cincinnati Plain Hydromatic, m.d., latest

No. 4-48 Cincinnati Duplex Hydromatic, m.d., latest

No 34-36 Cincinnati Duplex Hydromatic, m.d., with tracer control, latest

No. 34-36 Cincinnati Plain Hydromatic, m.d., with tracer control, latest

No. 58-72 Cincinnati Duplex Hydromatic, m.d., latest

No. 58-90 Cincinnati Duplex Hydromatic, m.d., latest

72"x6' Ingersoll Single Horizontal Spindle Traveling Housing Milling Machine, m.d.

No. 2B Brown & Sharpe Plain, m.d., latest

No. 2 Cincinnati Plain High Speed Dial Type, m.d., latest

No. 2 Cincinnati Medium Speed Dial Type Universal, m.d., latest

No. 0B Cincinnati Vertical, m.d., latest

No. 2, 3, 4 Cincinnati High Speed Vertical, Dial Type, m.d., latest

No. 2, 3 Cincinnati Medium Speed Dial Vertical, m.d., latest

No. 2H, 4H Milwaukee Vertical, m.d., latest

No. 2H½ Milwaukee Swiveling Head Vertical, m.d., latest

No. 2K, 3K, 4K Milwaukee Dial Vertical, m.d., latest

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UNUSUAL VALUES

Milling Machines—No. 1 Universal, No. 1 American (new) plain, No. 1 Vertical.

Drills—Large selection, single and multiple spindles also bench types, many of them new.

Gear Cutters—Brown & Sharpe No. 5—36" Gould & Eberhardt 42".

Grinders—Cylindrical B & S No. 11, Planer type 10"x36" Surface 12"x63", also new (small) Universal bench and floor type. All with coolant, motorized.

Lathes—14"x6', 8', 10'—16"x6', 8', 10'—18"x8', 10'—26"x10'—all cone drive, several motorized also (new) 18"x8' and 10' geared head, motorized.
Large stock 10" and 18" bench and floor type.

Planers—Single head 24"x6', 24"x8', 26"x8'.

Shapers—16", 20", 24" B.G. crank.

Turret Lathes—J & L 2"x24"—3"x36" also Acme, W & S Turret (vertical) boring and facing mills, 5 hole turrets, 30", 40".

SPECIAL—New totally enclosed dust proof, fan cooled ball bearing saw arbor motors, plain shafts to size or threaded, and with collars, measures only 3¼" from center of shaft to flatted end (1 h.p. to 15 h.p.) 2 or 3 phase, 3600 r.p.m.

WOOD WORKING MACHINERY—A very large stock of new and re-built, practically all motorized. New Motorized overhead cut-off and miter saw for wood, plastics, steel, aluminum and other metals. The above list is only a fraction of our stock which changes almost daily, therefore, tell us definitely what you want since we are adding considerable number of machines to our stock which are too many to list. What we have today may be sold tomorrow, so a list is really not dependable.

Drill—Foote-Burt No. 25 24" Hi Duty 3" capacity in steel. Motor attached.

PATTERN MAKING MACHINERY—42"x10' bed wood lathe, compound rest, rack and pinion feed to carriage; 16" heavy duty jointer, extra long bed, front table tilts for giving draft to pattern work; tilting table also tilting arbor rip and cut-off saws; band saws; jointer; floor and bench type trimmers; and also many other machines for pattern work.

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P. O. Box 88 Columbus 16, Ohio

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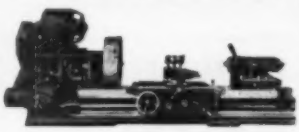
For Metal Working Machinery



54" x 20' 8" centers BRIDGEFORD NINE SPEED GEARED HEAD Q.C.G. LATHE: 30' Bed, V.B.M.D. with 35 HP motor.

72" x 21' 6" Centers NILES GEARED HEAD LATHE: Rapid traverse, with motor.

84" x 37' Centers PUTNAM GEARED HEAD LATHE: 52' Bed, 2 Carriages, Rapid traverse.

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1—18"x8' AMERICAN Engine Lathe.
1—#3 BARDONS & OLIVER Turret Lathe, complete for bar and chucking, late type.
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1—#1 BAKEWELL Tapping Machine, late type.
1—Single Spindle PRATT & WHITNEY Profiler, motor-driven.
#2 BROWN & SHARPE Surface Grinder, late type.
1—6"x30" type C Norton plain grinder, 1940.

Presses, Lathes, Grinders, New and used.

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900 HP Midwest Dynamatic Dynamometer, 250 Volts 1500—3500 RPM, Type 2025-W, serial No. 2290 Unused. W/Toledo Scale, controls, etc.
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Illinois #337 Base Pitch & Space Measuring Machine. Late Type—Like New. Capacity—12" Diameter gear. 15" between centers. Full set of Off-Set and Straight Contact Fingers, Dial Indicator, Tailstocks & Leatherette Cover.

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Milwaukee #2B Dble. Overarm, Horiz.
#1M Cincinnati Horiz. Rect. Overarm.
#3 Dial Type, H.S. Cincinnati Vertical Mill.
#2, #3, #4 Cincinnati High Power Vert.
#4-36 Cincinnati 4-Spdle. Duplex Hydromatic.
#4-36 Cincinnati Plain Hydromatic.
Sundstrand #0 Hydraulic Feed Rigidmill.
Cincinnati #0-8 Automatic Horizontal.
Cincinnati #0-8 Vertical.
Cincinnati #2-18 Automatic Horizontal.
Brown & Sharpe #12 (Electrics Built-in) 24".
Nichols Hand Mills (Late Type).
Van Norman #3V Ram Type Vertical Mill.
#4 & #5 Cincinnati High Power Horiz.
Cincinnati 24" Auto. Duplex.

LATHES

36"x30' LeBlond Q.C.G. Hvy. Duty Grd. Hd.
28"/56"x9' Putnam Q.C.G. Extension Bed Gap.
26"x14' Lodge & Shipley Q.C.G. Taper.
25"x14' LeBlond, Taper Att. Motorized.
24"x16' American, 11' C.C. Taper Att.
22"-46"x10' Q.C.G. Putnam Extension Bed Gap.
20"x18' American Q.C.G. Grd. Hd. Taper Att.
20"x10' Hendey Q.C.G. Taper Att. Motorized.
18"x6' American Q.C.G. Grd. Hd. Taper Att.
18"x6' Monarch Q.C.G. Grd. Hd. Motorized.
16"x8' Hendey Q.C.G. Taper Att. Motorized.
14"x8' Reed-Prentice Grd. Hd. (REBUILT)
14"x6' Hendey Q.C.G. Taper Att. Motorized.
12"x6' Hendey Q.C.G. Taper Att. & Equipment.

GRINDING MACHINES

Cincinnati 6"x18" Hydraulic Cylindrical. FILMATIC BEARINGS. Built-in Controls.
Cincinnati 10"x36" Plain Hydraulic Cylindrical Model #EA. Serial #5P2D1L-19. Filmatic Bearings. Built-in Electrics. Hydraulic Infeed.
Landis 10"x32" Crankshaft Grinder.
Norton 6"x30" 'C' Hydraulic Cylind.
Norton 10"x24" Hydraulic Cylindrical.
Blanchard #16-24" Vertical Rotary.
Pratt & Whitney 22" Vertical Rotary.
Norton 6"x18" Vert. Hydraulic Surface.
Norton 6"x18" Horiz. Surface. Hydraulic.
Abrasive 22"x7"x12" Vert. Surface.
Besley #205—18" Dble. End Disc Grinder.
Cincinnati #2 Tool & Cutter Grinder.
Norton 6"x18" 'C' Hydraulic Cylinder.
Brown & Sharpe #4 Univ. Cylin. 12"x60".
Brown & Sharpe #5 Cylindrical. 3"x12".
Brown & Sharpe #13 Univ. & Tool, 8"x24".
Gallmeyer Livingston #4 Tool & Cutter.
Heald #25 Horiz. Rotary
Heald #22 Horiz. Rotary
Porter-Cable #BG-8 Belt Grinder.
Norton #2 Univ. Tool & Cutter.
Thompson 18"x6" Hydr. Surface.
Pratt Whitney 14"x36" Vert. Rotary.

BORING MILLS

3⅛" bar Giddings & L. Horiz.
5" bar Barrett #2 Cylinder. Boring.
8" bar Barrett #6 Cylinder. Boring.
Ryerson #11 Horiz. 3" Capacity, #6 M.T.
24" Bullard Vertical, 220/440 motor.
42" Bullard Vertical, 220/440 motor.
54" Bullard Vertical 220/440 motor.
42" Gisholt Vertical, 220/440 motor.
120" Niles B & Pond Vertical

UNIVERSAL MILLING MACHINES

B & S #2, 20"x5"x17½".
B & S #1½, 20"x7"x18".
Garvin #2MU, 24"x8"x18".
Kempsmith #2, 28"x8½"x18".
Cincinnati #2M, 28"x10"x18".
B & S #3, 34"x10"x21".
Cincinnati #3S 34"x12"x20".
Cincinnati #2, 28x7½x18.
Kempsmith #3, 34x10x19.
LeBlond #4 Hvy. Duty. 40x10x14.

PUNCH PRESSES

Bliss #84 S.S.S.A. 56 tons. 10" Stroke. 20" between uprights.
Bliss #75½ S.S.S.A. 120 tons. 5½" Stroke. 24" between uprights.
O.B.I. Bliss #18, 19C, 20, 20B, 21 motorized.
O.B.I. Michigan, 36 tons cap. Wide ram & bed.
#68C Bliss Dble. Action 3-Crank.
#91C Toledo Sgle. Act. Dble. Crank S.S.
#30S Bliss S.S.S.A. 95 tons Cap.
#3A Bliss S.A.S.S. Dble. Crank. 42 Tons.

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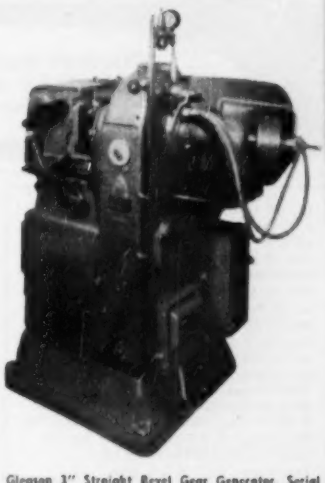
LATE TYPE TOOL ROOM EQUIPMENT

MONARCH #NN 36"x108" Grd. Hd. Lathe.
MONARCH #CB8 18"x96" Grd. Hd. Lathe.
MONARCH #W 16"x72" Grd. Hd. Lathe.
MONARCH #CW 16"/18½"x30" Grd. Hd. Lathe.
(10) LeBlond Regal 13"x30" Grd. Hd. Lathes.
(2) LeBlond Regal 15"x42" Grd. Hd. Lathes.
(2) Warner Swasey #1A Univ. Grd. Hd. Turret Lathes, one chucking, one Bar Feed & Chucking.
Kearney & Trecker #3K Horizontal Mill.
Kearney & Trecker #2K Vertical Mill.
Kearney & Trecker #2 Universal Horiz. Mill.
Shields-Morey 12"x60" Thread Miller.
DO-ALL 26" Band Saw.
Racine 'Oil-Cut' 6"x6" Hack Saw.
UNIVERSAL 4" Horiz. Boring Mill. 42"x60" table. 60" Vert. Travel. 96" to outboard support.
48" Giddings & Lewis Rotary Table.
UNIVERSAL 3" Horiz. Boring Mill. 28"x58" table. 27" vert. travel. 65" to outboard support.
UNIVERSAL 3" Horiz. Boring Mill. 34"x58" table. 34" vert. travel. 96" to outboard support.
3/60/220/440 volts motors.

IMMEDIATE SHIPMENT



Gleason 3" Straight Bevel Gear Generator. Serial #18884. NEW—1942. 220/440 motors. Gear Cabinet, full set of Index Gears, Segments. Auto. Index Attachment, Pneumatic Chuck Equip. Cutter Setting Gauges & Segment Setting Gauges. Duplete Cutting Cam and Duplete Feed Cam.

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Bullard 24", Spiral Drive, Vert. Late type
Bullard 24", "New Era" Vert., 1st class
King 24", Vert., 3 SCD, 12 speed
N B P 36-44, Vert.
Bullard 42", Vert., 2 hds on cross rail
Bullard 42" High speed Spiral Drive, Vert., Late
King 52" Heavy Duty Vert., 1 swivel hd & 1 turret hd. on cross rail
Bullard 54", Spiral Drive, Vert., 12 speed, 1 rail hd., 1 side hd.
P & H floor type, Horiz., 4" bar
Defiance #6, Horiz., 4½" bar
Heald #49, Single End Borematic

LATHES

American 14"x6', GH 8 speed, M.D.
American 16"x6', High Duty, Cullman Drive
American 16"x8', 3 SCD, Bowl head type
American 16"x8', High Duty, 3 SCD, DBG
American 16"x8', GH Turret on carriage
American 18"x8', 3 SCD, Bowl Head, BG
American 18"x10', 8 speed, M.D.
American 24"x8', GH, M.D., 8 speed, First Class
American 24"x12', GH, M.D., 12 speed, First Class
American 24"x14', GH, M.D., 8 speed, First Class
American 30"x15', GH, 12 speed, First Class, Immediate delivery
Boye & Emmes 16"x54", Motor in base, Late type
Boye & Emmes 18"x8', 3 SCD, DBG
Boye & Emmes 18"x8', 3 SCD, DBG, Self Contained
Boye & Emmes 20"x8', 3 SCD, DBG
Hendy 14"x6', 3 SCD Self contained
Hendy 14"x8', Yoke type head, 4 SCD, Drive All
Hendy 14"x8', Model E. B. M. Geared Leg
Hendy 16"x8', 4 SCD, SBG, Yoke head
Hendy 18"x8', Cone head
LeBlond 14"x8', 4 SCD, SBG, Drive All
LeBlond 17"x6', Heavy Duty, SPD, 12 speed
Leblond 17"x8', 3 SCD, DBG
LeBlond 21"x8', 3 SCD, DBG
LeBlond 24"x10', 3 SCD
LeBlond 25"x12', Heavy Duty, SPD
Lodge & Shipley 14"x36" centers, M.D., 12 speed
Lodge & Shipley 14"x8', 5 SCD
Lodge & Shipley 14"x8', 3 SCD, DBG
Lodge & Shipley 16"x30" centers, GH, 12 speed, Late type
Lodge & Shipley 16"x8', Selective Geared Head, 12 speed
Lodge & Shipley 18"x6', GH, M.D.
Lodge & Shipley 18"x8', 5 SCD, SBG
Lodge & Shipley 18"x8', 3 SCD, DBG
Lodge & Shipley 18"x8', Selective Geared Head, SPD
Lodge & Shipley 18"x9', Bowl head type, 3 SCD, DBG
Lodge & Shipley 20"x8', GH, SPD
Lodge & Shipley 20"x10', Selective Geared Head, 12 speed
Lodge & Shipley 27"x18', Patent Head, 18 speed
Monarch 14"x6', 3 SCD, DBG
Monarch 16"x54" centers, Model "CW"
Monarch 18"x8', Motor on leg type, 8 speed
Niles Timesaver 30"x10' centers, Double Wall Apron
Sebastian 16"x8', 4 SCD

GEAR CUTTERS & HOBBERS

Adams #3 Gear Hobber
Gleason #7 Hypoid Generator, Late Type
Brown & Sharpe #3—36" Gear Cutter, SPD
Gould & Eberhardt 36-S Vert. Gear Cutter
Brown & Sharpe #5—20" Gear Cutter
Fellows #615 Helical Gear Shaper
Gleason 3" Bevel Gear Generator
Gleason 6" straight Bevel Gear Generator

MILLERS

Cincinnati 3-36 Plain Hydromatic, First Class
Ohio 40" Tilted Rotary Miller
Van Norman #118 Bed Type, Production Miller
Van Norman #36 Ram Type, Plain Miller, Late
Cincinnati #3 High Power Rectangular Overarm, Plain Miller
Cincinnati #3 Plain Horiz. Miller
Brown & Sharpe #2B Plain Miller
Kempsmith #2 Plain Miller, 4 SCD, SBG
Brown & Sharpe #12, Plain Miller
Brown & Sharpe #2H, Plain Miller, Dble Overarm
Rockford #2 Plain, back geared high powered
Van Norman #2B, Plain Miller, LATE TYPE
Milwaukee #3-B Plain Miller DRO
Brown & Sharpe #3B Heavy Plain Miller
Cincinnati #3B Univ. Rect. overarm, First class
Milwaukee #2B Universal Miller, SPD, DRO
Cincinnati #3 Universal High Power Miller
Brown & Sharpe #3A Universal Miller
Cincinnati #4 Universal Miller
Brown & Sharpe #4A, Universal Miller, all geared feeds, first class
Newton Heavy Duty Vert., Hydraulic, NEW 1944
Brown & Sharpe #2 Vertical Miller
Cincinnati #4 Vert. High Power Miller, first class

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American 5' 14" Triple Purpose, first class
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Foodick 5' 14" Plain
American 6'10", Plain, Boilermaker's
American 7'10", Triple Purpose
Cincinnati Bickford 7' 15", Plain
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MILLER—Hor. Plain, K. & T. No. 4K (Late)
PLANER—N.B.P., 48"x48"x26', 4 Heads
PUNCH—Beatty No. 7—1¼" thru 1" (1947)
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Z & H #7—30 Ton, Percussion
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Serial No. 630902. — Model M-1550.
12" bar capacity.
Rapid traverse to turret head.
Ratchet type power bar feed with motor.
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No. 25T G. & L. 2½" table Hor. Mill, 1942
4" Univ. Table Mill, 60" vert. 96" hor., '43
36" & 42" King Side Hd. Vert. Mills, '43
Nos. 1A & 3 W. & S. Turrets, bar & chuck
Nos. 3 2MH Cinci. Pl. Dial Millers, late
Nos. 3E & 3H K. T. Pl. Dial Millers, late
No. 36 Van Norman Pl. Miller, ram, '43
No. 2G Kempsmith Univ. Miller, 1943 (3)
No. 2416 Keller Duplicators, late
No. 9J Gorton Duplicator & Vert. Miller (2)
Gear Cutter, No. 13 B. & S., spur & bevel
30"x120" con. Axelson Lathe, T.A.
30"x120" Hanchett Planto Surface Grinder
3" Univ. Table Mill, 40" vert., 72" hor., '43
No. 3 Stand. K. & T. Univ. Miller, Timken
Gear Gen., No. 61A Fellows, 1943
Gear Cutter, 3-36" B. & S. Spur, Late
12"x48" Hanchett Vert. Spin. Surface Grinder
96"x96"x24' N.B.P. Planer
8' 17" col. Carlton Radial, M on arm

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Colburn 62" Hvy. Duty Vertical Boring Mill
G & L and Universal 3" Bar Horiz. Boring Mills
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Mailen 6-Sp. Hole Hog Drill, Barnes 4-Sp.
20" All Grd. Camel Bark Drill
Cin-Bick 3' & Morris 3½' Arm Radial Drills
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L & S 20" x 8', 18" x 12', 20" x 10', 28" x 12'
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B & S Nos. 2-B & 3-B, Cin. No. 3 Mil, No. 2-B & 3-B, Cin. No. 5 LeBlond No. 4, Grd. Hd. Plain Millers
B & S No. 2-A & 3-A, Mil, No. 2-B, Cin. No. 1-M, Cin. No. 2 Grd. Hd. Univ. Millers
Avey 2-Spindle MAS Drill Press late.
Niagara 12' Power Square Shear, 10-Ga. 18" gap late

MONA MOTORS

Cin. #3 Vert. Miller Late
Cin. 24" M.D. Univ. Shaper.
Cleveland 48" x 12' Table Open-side Planer, 3 Hds.

McDONALD MACHINERY CO.
1531-35 No. B'way., St. Louis 6, Mo.

VALUES IN LATE-TYPE MACHINERY

Pratt & Whitney ½B Deep Hole Drill and Pratt & Whitney Deep Hole Drill Sharpener

EXCELLO NO. 35 THREAD GRINDER

BORING MACHINE, Heald #49, Sel. End	$1650
GEAR GENERATOR, Gleason No. 7	4900
GEAR GENERATOR, Gleason No. 3	1000
GEAR GRINDER, Red Ring Prec., SGC-18	1500
GEAR GRINDER, Internal GG30-18	950
GRINDER, Bryant No. 5 Chucking	1150
GRINDER, Sellers No. 47, Univ. Tool	1100
GRINDER, Plain Cly. Fitchburg 6x18"	850
GRINDER, Heald No. 81, Size-Gage	2200
GRINDER, Norton, Surface, 6x18	950
MILL, Brown & Sharpe No. 12 Production	1700
MILL, Brown & Sharpe, 000 plain	850
SAW, Do-All, Mod. V-00, 00" throat	2000
THREAD GRINDER, Excello No. 31	700
TURRET LATHE, B & G No. 5 Univ.	950

Many other late type machines in stock that are priced to fit your budget. Call or Write

PHONE: DEARBORN 2-6343

Lincoln MACHINERY SALES CORP.

LATEST TYPE *Nearly New* MACHINES

BORING MILLS—Horizontal
DETRICK & HARVEY 4" bar, Floor Type, M.D.
GIDDINGS & LEWIS #22T, 2½" bar, Latest Type
HEALD 48A, 49 single end, Bore-matic, Latest
LANDIS—#15—2½" bar, Floor Type, Latest Type
LUCAS #41, 2" bar, Table Type, Late Type
LUCAS #43, 3" bar, Table Type, Latest Type
NILES-BEMENT-POND 5", 5" bar, Floor Type, M.D.
UNIVERSAL 2" bar, high speed, latest type

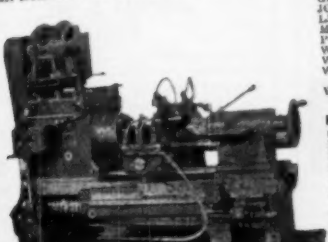
BORING MILLS—Vertical
BULLARD 24", 30" Turret, "New Era" Side Head, M.D.
BULLARD 24", 36", 42" Vert. Turret "Spiral Drive".
High Speed, Latest Type, Latest Type
BULLARD 64" "Cutmaster"
COLBURN 72", 2 swivel heads, PRT, M.D.
NILES 100", 3 swivel heads, Rapid Traverse, AC M.D.

DRILLS—Miscellaneous
BARNES H-3 "Hydram" Hydraulic, 3" capacity—for inverted drilling, Latest Type
LELAND & GIFFORD #11-M2, 4 Spindle, Latest Type
LELAND & GIFFORD—2, #24M5 Single Spdle
LELAND & GIFFORD #12 LM5 6 spindle, Latest
LELAND & GIFFORD #12 LM5 6 spindle, Latest
NATCO #4AL Multiple, 36 spindles, Hyd., Latest Type

GEAR CUTTING EQUIPMENT
BARBER COLMAN Type A Hobber, Long Base, for Splines, Latest
BARBER COLMAN #12 Hobber, Single and Double Overarm, Motor Drive
BILGRAM 6" and 12" cap., Bevel Gear Gen., M.D.
BROWN & SHARPE #13 Spur and Bevel Cutter, M.D.
BROWN & SHARPE #13 Spur and Bevel Cutter, M.D.
CROSS #1 Tooth Rounding Machine, Motor Drive
CROSS #30 Gear Chamferer, Latest Type
FELLOWS Model 6A, 61A, 6Z2, 7A, 7, 72, 725, 77 High Speed Gear Shaper, Latest Type
FELLOWS #12M Involute Measuring Instrument, latest
FELLOWS #13L8 Lapper, latest type
FELLOWS #M Rod Liner, Latest Type
GLEASON #16 Hypoid Spiral Grinder, Latest Type
GLEASON 5", 12" straight bevel generator, latest type
GLEASON #4, #6, #15 Bevel and Hypoid Tester
GLEASON #16 Hypoid Generator, Latest Type
GLEASON 14", 17", 17", 90° Straight and Bevel Gear Planer, Motor drive
GOULD & EBERHARDT 12H Hobber, DIFF., Latest
GOULD & EBERHARDT 14H Hobber, Motor Drive
GOULD & EBERHARDT 06H Hobber, with diff. M.D.
GOULD & EBERHARDT 10" Grinder, hyd., latest
PRATT & WHITNEY 10" Grinder, Motor Drive
SCHUCHARDT & SCHUTTE #1 Hobber, Motor Drive

GRINDERS—Cyl.—Plain & Univ.
BROWN & SHARPE #1, 2, 3, 4, Universal, Latest Type
BROWN & SHARPE #5 Plain, 3 x 12, Latest Type
BROWN & SHARPE #5 Plain, 3 x 12, Latest Type
CINCINNATI 16"x26" Centers Model E.R., Universal, Hydraulic, Latest
LANDIS #A12, Type H, Plain Hyd., Latest Type
LANDIS 6"x18" Type C Plain, Hyd., Latest Type
LANDIS 6"x18" Plain Roll, Motor Drive
LANDIS 10"x36" Plain Roll, Motor Drive
NORTON 8"x18", 8"x36", 14"x36", 16"x72" Type C. Plain, Latest Type

GRINDERS—Miscellaneous
BARBER COLMAN #3, #4 Hob Sharpener, Latest
BROWN & SHARPE No. 13 Unit. Cutter & Tool, Lat.
BROWN & SHARPE No. 13 Unit. Cutter & Tool, Lat.
BRYANT #3, #6, 16-C-16, 16-CF-16, 24-36" Internal, Hydraulic, Latest Type
CINCINNATI "Monoset" Tool & Cutter, Latest
FITCHBURG 14"x25" Spline hydraulic, latest
GARDNER 24-52" Disc Grinder, Latest Type
GLEASON #12 tool sharpener, Latest Type
HEALD 72A3, 72A5 "Gagematic" Internal, latest
HEALD 72A4, 72A5, 74 Internal, latest
HEALD 72A6 Internal, Centerless, Bissmatic and Gagematic, Latest Type
HEALD #81 Internal, Centerless, Bissmatic and Gagematic, Latest Type
KEARNEY & TRECKER Face Mill Grinder, Latest
LANDIS #6, 6x24 Thread, latest type
La POINTE 60" Universal Broach Sharpener, Latest
THOMPSON 9"x48" Auto. round broach M.D.
VAN NORMAN #639, #73 Oscillating Radius Grinder, Latest Type
VAN NORMAN #666 Crankshaft ReGrinder, Latest



JONES & LAMSON "FAY" 24"x24" Centers
Automatic Turning Lathe—Timken Bearing, Hardened steel ways, Latest Type

HOW MUCH OBSOLESCENCE CAN YOU AFFORD?

Efficiency methods today have established certain obsolescence standards for machine tools. Actual practice proves that a machine tool in good condition and NEARLY NEW—are one of the best buys that a shop can make, providing of course that you buy it from a reliable dealer who will stand behind it.
Morey Tools, plus the Morey reputation established for over 35 years, are your assurance that you can safely SAVE MONEY and get the utmost value for every penny of the money you invest. We have in our stock over 2000 NEARLY NEW machine tools. At a low cost, and with a guarantee of value, you can safely buy and install Morey NEARLY NEW machine tools and push back the bogey of "obsolescence" wherever it threatens your profits.

GRINDERS—Surface
ABRASIVE 3B, 8"x24" Hyd., Latest Type
BLANCHARD #11, 16" dia. mag. chuck, Latest
BLANCHARD #16, 24" dia. mag. chuck, Motor Drive
BLANCHARD 16A Vertical, Dial Feed, Motor Drive
HANCHETT Series 300 12"x24" Vert. Hyd., Latest
HANCHETT #36 Vert. 36" dia. mag. chuck, Latest
HANCHETT #120 20x120" Plano, Hyd., Horiz. Latest
HEALD #23 Rotary, 12" chuck, latest type
HEALD 25A—rotary—16", 24", 30" chuck. Hyd., Latest
NORTON 8x18 Hydraulic, latest type

JIG BORERS
KEARNEY & TRECKER Model B Automatric, Latest
PRATT & WHITNEY 1A, Motor Drive
SOCIETE GENEVOISE (SIP) #4 Precision, Table 19"x27", Motor Drive

LATHES—Engine and Mfg.
AMERICAN 20"x360 centers, 2 carriage, motor drive
JONES & LAMSON "Fay" 20x20", 24x24 autom., latest
LeBLOND 21"x60" Centers, TIMKEN, latest type
LEHMANN 16x30" Centers, TIMKEN, Latest
LODGE & SHIPLEY 16"x30", 14"x30" Timken, Latest
LODGE & SHIPLEY 18x72 centers, M.D.
LODGE & SHIPLEY 18x72 centers, M.D.
LODGE & SHIPLEY 24"x120" centers, Model 24", Latest
LOSWING 4x60, 4x96, 4x96, Model BS, Timken, latest
MONARCH 10"x20" centers, Model CKS, Timken, late
MONARCH 12"x30" Centers, Model CK, Timken, latest
MONARCH 14"x54" Centers, Model CM, Timken
MONARCH 24"x54" Ball Bearing, Geared Head, M.D.
MONARCH 25"x192" Centers, 3 Carriages, Timken Bearing, Model CM, Motor Drive
MONARCH 27"x456" Centers, 3 Carriages, Timken Bearing, Model CM, Motor Drive
NILES 20"x50' Boring "Time Saver" Timken, Latest
PRATT & WHITNEY 16"x30" Centers, Timken, Latest
PRATT & WHITNEY 10"x20" centers, Bench, latest
PRATT & WHITNEY Centers, Motor Drive
PUTNAM 42"x25' Centers, Model A, Latest
REED PRENTICE 20"x54" Centers, Timken, latest type
SPRINGFIELD 16"x30" centers, Timken, Latest Type
WARD, HAGGAS & SMITH—18/36x60" centers 4sp. motor drive, Latest Type

LATHES—Hub and Cutter Relieving
CLEVELAND 13"x16" Centers, Cutter, Motor Drive
MICHIGAN 1712 Universal, Latest Type
U.S. Tool #810B, 9"x12" Centers, Cutter, Latest

LATHES—Turret
BARDONS & OLIVER #5, #7, TIMKEN, Latest Type
CINCINNATI ACME No. 1 Timken, Latest
FOSTER #48FU "Fastermatic," Timken, Latest
GISHOLT #1L, #2L, #3L Universal, Timken, Latest Type
GISHOLT #3, #4 Univ., Timken, Latest
GISHOLT #3, #4 Univ., Timken, Latest
JONES & LAMSON #2 Univ., Timken, Latest
LIBBY "International" 1H3 Univ., Timken, latest
MOREY 50DE, No. 2, No. 3 Timken Bearing, latest
POTTER & JOHNSTON 5-B Universal, Timken Bearing
WARNER & SWASEY #2, #3, Timken, Latest type
WARNER & SWASEY #2A Universal, Timken Bearing
WARNER & SWASEY 2A Universal, Timken Bearing
WARNER & SWASEY Bar and Chucking, Latest Type
WARNER & SWASEY "Pre-selector" Bar and Chucking, Latest Type
WARNER & SWASEY 3A Universal, Timken Bearing
WARNER & SWASEY Bar and Chucking, Latest Type

MILLING MACHINES—Mfg.
GRAY 84"x52"x16" Planer Miller, 3 heads, Latest Type
HALL 8U6 L. Planetary, latest type
INGERSOLL 42"x28"x13" adj. rail, 4 heads, AC, M.D.
INGERSOLL 42"x28"x13" adj. rail, 2 heads, AC, M.D.
INGERSOLL Planer Type, 2 heads, AC, M.D.
INGERSOLL 22x24x16" Planer Type, 2 heads, AC, M.D.
INGERSOLL 36x24x13" adj. rail slab, M.D.
SUNDERLAND Model 3A Duplex 42" feed, Latest
TAYLOR & FENN M80 Duplex Spline, latest

MILLING MACHINES—Plain
BROWN & SHARPE #2, Light Type, Timken, Latest
BROWN & SHARPE #13, 24" feed, Latest Type
BROWN & SHARPE #00, Timken, Latest Type
BROWN & SHARPE #2B, 3B, Timken, Latest Type
CINCINNATI 9-S, 1-12, 2-18 Automatic, Latest Type
CINCINNATI #3, #4, #5 High Power, Late Type
CINCINNATI 4-36 Hydrocentric, Simplex, Latest Type
CINCINNATI 4-36 Hydrocentric, Simplex, Latest Type
KEARNEY & TRECKER #2H, 3H, 4H, 5H, Latest
KEARNEY & TRECKER 1218, 1404, Simplex, Latest
KEARNEY & TRECKER 4K, Timken, Late
KEARNEY & TRECKER 4K, Timken, Late

MILLING MACHINES—Thread
LEES BRADNER Model LT, 6"x36" Centers, Latest
LEES BRADNER Model HT, 12"x54" Centers, Latest
MOREY 12x36", 60° 120° 15a centers, Latest Type
PRATT & WHITNEY 4½"x12" Model C, Latest Type
PRATT & WHITNEY 6"x60" Model C, Latest Type

MILLING MACHINES—Universal
BROWN & SHARPE No. 2A Timken Bearing, Latest
BROWN & SHARPE No. 3A, 4A, Motor Drive
BROWN & SHARPE No. 3A, 4A, Motor Drive
CINCINNATI #2MH, Timken, Latest Type
KEARNEY & TRECKER 2H, Timken, latest Type
KEMPSMITH #4 Maxi-miller, Timken, latest type
VAN NORMAN #3 duplex, Motor Drive
VAN NORMAN #36, #36, Timken, Latest Type

MILLING MACHINES—Vertical
BROWN & SHARPE #2 Standard Timken, Latest
CINCINNATI #4, Dial Type, High Speed, Latest
CINCINNATI #5 TIMKEN, Latest Type
GORTON 3D, 4½D Saver-Mover, Latest Type
KEARNEY & TRECKER 2H, 2K, 3H Timken, Latest
KEARNEY & TRECKER Double Spindle Profiler, Latest
MOREY 12M Single & Double Spindle with or without hydraulic duplicator, Timken bearing, Latest Type
REED PRENTICE 3VO, Latest Type

PLANERS
BETTS (CONSOLIDATED) 84"x32"x16" 4 heads, Box Table, Rapid Traverse, D.C. M.D., Late Type
BETTS (CONSOLIDATED) 108"x84"x30" 4 heads, Box Table, Rapid Traverse, D.C. M.D. Late Type
CINCINNATI 30"x30"x8', Openside, Motor Drive
CLEVELAND 48"x48"x12' Openside, PRT, DC, M.D.
DETRICK & HARVEY 48"x48"x16' 4 heads, Hydraulic Rapid Traverse, A.C. Motor Drive
NILES 108"x84"x42" 4 heads, Box Table, Rapid Traverse, D.C. M.D., Late Type
NILES 108"x84"x42" 4 heads, Box Table, "Time Saver", Box Table, 3 heads, D.C. reversing motor, Latest Type
NILES 48"x48"x12'
NILES 48"x48"x14' "Time Saver" Box Table, 3 Heads, PRT, VARI-VOLT-GEB Drive, Latest
NILES 96"x96"x24' 4 heads, Rapid Traverse, Box Table, D.C. reversing motor drive

PRESSES
BIRDSBORO 325 ton, vert, hyd., Latest Type
BLISS 75-35 Hydro-Dynamic, Double Action, Latest
GLEASON 25 ton Straightening, Hyd., Motor Drive
LAKE ERIE 500 ton Vert. Hyd., Latest Type
TOLEDO #35A, 35 ton geared, Motor Drive
NILES 400 ton, Hydraulic, Latest Type
NIAGARA #56B, 56 ton geared, Motor Drive

SCREW MACHINES—Automatic
CLEVELAND 9/16", 1-1/16" Model A, Latest Type
CONOMATIC 2¾" spindle, high speed, Latest Type
GOSS & DeLEEUW 3" 5 spindle Chucker, Work Rotating, Latest Type

SHAPERS & SLOTTERS
AMERICAN 20" Heavy Duty, Motor Drive
CINCINNATI 20" High Speed, Latest Type
DILL 36"-24" Vertical, Motor Drive
ROCKFORD 36", Hydraulic Shaper-Planer, Latest

SHEARS—Power
QUICKWORK #5, ¾" Cap., Rotary Shear, M.D.
QUICKWORK #6, ¾" Cap., Rotary Shear, M.D.
WYSONG & MILES #372, 14 gauge x 6' Latest Type

MISCELLANEOUS
AJAX 3½" Forging and Upsetting, M.D.
BAKER #5 Kerosetor Motor Drive
BARNES #173, 266H, 307, 307B Vertical Hone, Hyd.,
BARNES #173, 266H, 307, 307B Vertical Hone, Hyd.,
Self-Oiling, Latest Type
CAMPBELL #401 Abrasive Saw, Latest Type
CAMPBELL #401 Cooiant Clarifier, Latest
DE LAVAL #194 Coolant Superfinisher, Latest
FOSTER 4"x12" 4"x26" Superfinisher, Latest
HELLER Model 8S-1 Cold Saw, 8" cap., M.D.
LANDIS 3 Single Spdle. Belt Threader, M.D.
MANVILLE 2D 7/16" Cap. SSSD, Ball Header, M.D
NAZEL #4B Pneumatic Hammer, M.D.
PEERLESS 14"x14" Hydraulic Hack Saw
PRATT & WHITNEY (KELLER) Type BL-2416 Type G, Copying 2 and 3 dimensional, Latest Type
ROWBOTTOM Cam Miller, Motor Drive
STURDYBENDER 5/16"x6' Power Press Brake, Latest Type

WATCH THIS PAGE!

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AUTOMATICS

9/16", Acme Gridley RA6, new 1946
½", No. 00 Brown & Sharpe, serial 7909
1⅝" New Britain No. 01, serials, 24231, 24232 & 24439
1⅝" Greenlee, Serial A463
1⅝" Consmatic 8 spdl., Serial 3119XX
2⅝" Acme Gridley RA6, new 1943
4½" Consmatic 4 spdl., serial 2191K
No. 5DEZ Potter & Johnston chucking
No. 16 New Britain 6 spdl. chucking
6"—6 spdl. Bullard Multaumatic, type A

BORING MACHINES

Nos. 47A, 48A Heald Borematic
No. 49 Heald double end
Nos. 1120, 1212 & 2112 Excello
Vernon Jig Borer
No. 2 Pratt & Whitney jig borer
3", No. 31 Lucas horizontal
3½", No. 32 Giddings & Lewis
3½" No. 32 Lucas horizontal
4½" No. 33 Lucas horizontal
5" Jones planer table type
52" King vertical
100" Niles Bement Pond, vert.
24" Bullard vertical turret lathe
30" Bullard single turret head vert.
30" Bullard spiral drive vertical turret lathe
Natco 1-way horizontal
No. 4 HH Baker 2-way with mult. heads
Matson double end

BROACHES

No. 1 Foote Burt duplex vertical surface
10 ton, 30" stroke Colonial duplex vert. surf.
15 ton, 30" stroke American duplex vert. surf.
No. 3 Lapointe screw type
No. 3 KA Gilgear hydraulic
2 ton American hydraulic

DRILLS, MULTIPLE & MISC.

12 spdl. No. 30 Natco rail
12 spdl. No. 25 Baush rail
16 spdl. No. 28L Natco multiple
22 spdl No. 14 Natco multiple
24 spdl. No. 84A Natco multiple
34 spdl. No. 30 Natco multiple
42 spdl. No. B16 Natco multiple
Matson two way
Type 4HH Baker two way hydr
Natco one way
Barnes 2 spdl. deep hole
No. 15½ Foote Burt hydraulic
5 spindle Detroit horizontal
6'-15" Droses radial
4'-11" Cint. Mach. univ. radial
24" 4-spdl. Allen sensitive
24" 6-spdl. Foote Burt sensitive
24" 4-spdl. Demco sensitive
24", No. 4B Edlund, power feed

GEAR MACHINERY

Nos. 6 & 72 Fellows gear shapers
No. 5M Adams Mfg. hobber
Types A & T Barber Colman
Nos. 3 & 12 Barber Colman
No. 8M Fellows gear chamfer
No. 130 Cleveland Rigid hobber
No. 8H, 12H, 16HS & 18H G. & E.
Nos. 1, & 5A Lees Bradner
24"x12" Flather automatic spur
Cimatool Peerless chamferer
2 spdl. Ligo chamferer
5" Gleason spiral bevel gen.
No. 7 Gleason cutter grinder
18" Gleason lappers & testers
8" Red Ring gear lapper
12" Red Ring gear shaver
"MAL" Barnes gear lapper

PRESSES

No. 6 Amer. Can OBI
No. 3 Consolidation OBI
Nos. P1, P2, P3, P4 & P5 Ferracute
No. 32P Toledo punching
No. CA4 Ferracute adj. bed
No. 11 Toledo adj. bed horning
Nos. 75½", 75½ & 304 Bliss
No. 52 Toledo Arch Frame
No. 506 Bliss straight side, Roll Feed
No. 56 Toledo straight side
48", No. 205C Toledo gap frame double crank
600 ton Hamilton forging
1500 ton Burroughs hydraulic hobbing
150 ton EG 52 Ferracute coining
1000 ton No. 666 Toledo coining
No. 52 Toledo arch frame
48" No. 93½ Toledo double crank
No. 202B Toledo double crank
350 ton No. F1350-36 Clearing
No. 1½ & 1½C Bliss cam draw
1000 ton Baldwin Southwark hydraulic
20" stroke, 42" x 54" bed, 50" daylight, new 1940
100 ton HPM hydraulic
75 ton Southwark hydraulic
35 ton Metalwood straightening

MILES MACHINERY CO.
SAGINAW, MICHIGAN

LATHES

Monarch 20"x72" centers model "M", 16 spd. gr. hd. 22½" swing, Monarch auto. sizing controls (late)

Lodge & Shipley 24"x12', 12 spd. sel. gr. hd. 27½" swing
Boye & Emmes 18"x14' M.D. dbl. bk. gr. 10' center distance
Flather 18"x8' M.D. dbl. bk. gr. 13'0" center distance
Bridgeford 36"x56', 15 spd. gr. hd. 38" swing 48' C.D. mtrzd. carriage

Niles-Bement-Pond 48"x30' centers, gear head, heavy duty, 2 carriages, rapid traverse, taper attachment, 30 HP AC motor drive, used short while, excellent condition (Late)

VERTICAL BORING MILLS

Bullard 24", 36" & 42" "New Era" and "Spiral Drive" 3 and 4 jaw chuck tables
Betts 90", 2 heads on rail, adjustable rails AC or DC motor drives
Niles 80" and 100", 2 heads on rail, adjustable rails, AC or DC Motor Drive

HORIZONTAL BORING MILLS

Defiance 25A, 3½" bar, face plate to outer support 72", #6 taper, added vert., and cross range (late)
Universal 4" bar "Tri-Way", face plate to outer support 72", #6 taper, added vertical range (late)
Fisher 9" floor type, vert. travel hd. 90" hor. travel col. 110", plates (very late)

RADIAL DRILLS

American 4'12" triple purpose M.D. #4 taper and 4'11" American 24 speed 7½ HP motor-on-arm, triple purpose, #4 taper
Fosdick 5'17" and 5'13" motor-on-arm "Economax" hydr. #6 taper, (very late)

SHAPERS

Rockford 24" "Special" Hydraulic Plain table 10' to 140'/min. cutting speed—20" max. stroke —rapid traverse to table—power elevation to table—actual use less than 25 hours

GE 32" M.D. universal crank industrial, late Stockbridge 20" M.D. bk. gr. crank

UNIVERSAL MILLERS

Van Norman #25U horiz. knee type, wkg. tbl., 50"x12", range 24½"x10"x17", (very late)
Brown & Sharpe #1A dbl. over. motor-in-base, wkg. tbl. 41¾"x11¼", range: 22"x8"x10"

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DRAW BENCH

4 Bar Type, 1¼" Capacity Hex. or Round Steel. 90 Tons per day output. Mfg'd. by Standard Engineering Co.

100 H.P. with 36 ft. Finish Draw.

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EVERY ITEM GUARANTEED

All Late Type

#96-F Toledo Press, 300 Ton, 120x52 Bed, 14" stroke. W/3 air cushions, mtrs. controls. A-1 cond.

Bullard Multaumatics, 16", 12", 8", late
#3 Cinn. Centerless Grinder New 1945, used 7 months!
#28/60 Vertical Cincinnati Hydrotel, '44
5" Fisher Horiz. Floor Type Boring Mill, Late
5" Bar Table type boring mill, Giddings & Lewis #350T
#12 Brown & Sharpe Production Mills, 48½" x12" table size, $2250.00 ea.
9/16", 1", 1¼", 1⅝", 2¼", 2⅝" RA6 Acme Gridley Auto.
20 to 50 Ton Ferracute Presses, Stiles type only $275 and up!

CHUCKERS

6" 6 spdl. & 8" spdl. Acme Gridley Chuckers. All Latest Type (3)

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PAULS MACHINERY COMPANY
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1—8' HILLES & JONES PLATE SHEAR

⅞" Capacity

8' 6" Actual Clearance

36" Depth

40 H.P. 220/440 Motor

Excellent Condition

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Dennison 8-ton Vert. Press, 1948
No. 2B K & T Plain Mill.
No. 2B B & S Plain Mill.
No. 1-12 Cincinnati Auto. Mills.

D. E. DONY MACHINERY CO.
47 Laurelton Rd., Rochester 9, N. Y.

GRINDER, Cinc. 12x36 Univ. Hydraulic
GRINDER—DISC, Besly 218 Opp. Type 23"
LATHE—AUTOMATIC, Gisholt #12 Hydraulic
LATHE—VERTICAL TURRET, Bullard 36" Late
MULTAUMATIC, Bullard 16" 8-Spindle Std.

BRM MACHINERY CORPORATION
57-8 Edison Place
Newark 2, New Jersey

#18 GLEASON HYPOID GEAR GRINDERS
(3) #18 GLEASON FORMATE HYPOID GEAR GRINDERS
Largest Pitch Diameter 24", Longest Cone Distance with 12" Wheel 12⅝", PRICE ..... $8,000.00 ea.
MFG. IN 1947 *EQUAL TO NEW*

WINSTON MACHINERY CO., INC.
517 South Delaware St., Indianapolis 4, Indiana

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AUTOMATICS
Brown & Sharpe, Nos. 00G, CECO ⅝", Swiss Type
Fay Automatic, 12"x81".
New Britain No. 61—2¼" 6 spd.
Peterman #1 Swiss, 5/16" cap.

BORING MILLS
Giddings & Lewis No. 0, No. 25T.
Lucas No. 31, horiz.
Heald #49 double spindle, #48A Universal 3" horiz. equipped.
Bullard 24", 36", 42" VTL
King 72" vertical

DRILLS AND RADIALS
Barnes No. 242, No. 5 Morse
Carlton 8'-19" column
Canedy-Otto 3'-9" col.
Sibley 24"-28", Power Feeds
Hamilton, Langelier, Hi-Speed.

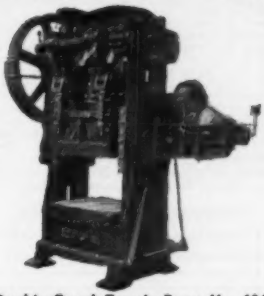
ENGRAVERS
Gorton No. 3U, 2 dimen.
Deckel GK1, & GIL, 3 dimen.
Gorton Cutter Grinders 375-2, 265-6.

GEAR EQUIPMENT
Barber Colman No. 3 Precision
Fellows #7, 72, 712, 725, 7125, High Speed.
Fellows 645Y Spur & Spiral
Gleason #2 Surface Hardener.
Gleason 3" Spur Bevel Generator
Hamilton Hobber #00
Michigan, Gleason, Fellows Checkers.
Mikron Gear Hobber.

GRINDERS, MISCELLANEOUS
Brown & Sharpe No. 5 cyl. 3" x 18", 3" x 12".
B. & S. Nos. 1, 2, 3 Univ.
B. & S. No. 13 Univ. & Tool.
Cinc. No. 2 Centerless Filmatic.
Cinn. 12 x 48" Filmatic Univ.
Cinn. #2 Univ. Tool & Cutter
Covel No. 91A Univ. T. & C.
Dalzen Thread, latest
Gardner #226, 30" Disc.
Hanchett #228 Disc. Dbl. opposed w. M.D. Feed.
Heald 72A3 Sizematic Int. Centerless.
Jones & Lamson Thread, Univ. TG636
K.O. Lee Tool & Cutter.
Landis Centerless.
Landis No. 4H Cyl. 4 x 12", No. 6 Thread, 10 x 36" angu.
Norton No. 2 Tool & Cutter, Hyd.
Oliver 510 Drill Grinder, Sellers 4G Drill Grinder

GRINDERS, SURFACE
Abrasive #2B, 8"x24" cap.
Abrasive No. 33, 34 Vert., 8x24.
Blanchard No. 11, 16" Mag. Chuck.
Blanchard #16A—30" Chuck
G & L Hyd. #25, 6x18", #25, 8x24", #45, 12x24".
Hanchett Model 300, 13 x 48".
Heald #25A Rot. Surf 16" hyd.
Norton 6x18", and 10x36" Hyd.
Reid No. 2A P.F. MIB.
Reid No. 2C Motor Spdl. Hand Feed.
Thompson Hyd. 6 x 10 x 18", 6 x 12 x 18".

LATHES
Bradford 14"x6', G.H. Latest Sebastion 12"x4'
Hardinge Precision, 1" Collet Cap., Rivett. Precision.



Bliss Double Crank Toggle Press No. 406—48"

Bliss #1½B Toggle Press Geared, #3½A Toggle
Bliss No. 304A, 306 Straight Side Presses.
Bliss #8—Bed 42x96"—250 Ton.
Bliss 645B, 650, 675 High Production Presses.
Henry & Wright 25 and 75 Ton Dieing Presses.

HYDRAULIC PRESSES

DOWN MOVING RAM, SELF CONTAINED

MANUFACTURER	TON CAP.	STR.	OPENING	PLATEN
Lake Erie	500	36"	48½	35 x 36
H.P.M. Double Action	500	24"	30"	36 x 36
Watson Stillman Shaft Straightener	500	24"	57"	24' bed.
Denison	25/50	18"	23"	22 x 20
Hamilton	50"	20"	30"	22 x 30
Southwark, D. A. Clamping Plate	125	30"	2' to 4'	84 x 30
Oilgear Shaft Straightener	35	8"	12"	84 x 11

DOWN MOVING RAM, WITHOUT POWER UNIT

Mesta	750	42"	80"	44 x 44
Chambersburg	300	10"	27"	22 x 36
Southwark	350	42"	78"	28 x 48
Southwark	550	23"	48½"	42 x 32

UP MOVING RAM PRESSES

Southwark	600	20"	27" to 48"	34 x 24
Waterbury Farrel	800	6½"	28"	32 x 24
Birdsboro	800	20"	30" to 48"	40 x 32
Watson Stillman	300	12"	21"	24 x 20
Watson Stillman	300	12"	19"	20 x 20
Watson Stillman (Hob) New and Used	300	6"	22"	16 x 16
HPM	180	15"	14½"	30 x 30
Dunning & Boschert Molding Press	300	12"	38"	24 x 32 Mold
Stokes Molding Press and Pump	100	7"	24"	22 x 15
Stokes Molding Press and Pump	150	8"	31"	24 x 23
Elmes—With Elec. Plates	50	6"	12"	18 x 18
Stewart Boling	85	10"	19"	20 x 20

WHEEL PRESSES
NILES — 600 ton 96"; 500 ton — 48"; 300 ton — 48".

INJECTION MOLDERS

ACCUMULATORS

Mfr.	Size	Pounds
HPM	6" x 9"	2000
General Electric	15" x 11'	400
Watson Stillman (13 gal) Hydr. Pres.	42 x 9 x 48"	3000

Hendey G.H. 16x30", Rel. Att.
LeBlond Regal 16"x3½', 18"x24", 16"x30", 16"x48" TA, 19"x48" TA, 21"x60"
LeBlond Heavy duty 16"x30".
Lodge & Shipley 16 x 78" T.A.,
Collets, etc., and 26" x 54" equipped.
Monarch 10"x20" EE.
Monarch 12x30" Dble. Compound, swings 18"
South Bend Q.C.G., 13"x6', 10"x4', 14½"x6'.

MILLS, PRODUCTION
Brown & Sharpe, No. 000, 12, 21.
Cincinnati No. 1-12, 1-18, 2-18 Mfg., 50-96 hydromatic
U. S. Multimiller, 1 and 2 Spindles.
Sundstrand 00 Rigidmills, Kent Owens IV.

MILLS, PLAIN AND UNIVERSAL
B. & S. No. 2B Pl., No. 2A Univ.
Cincinnati No. 3 Plain.
Cincinnati No. 2MH Univ., H.S.
Milwaukee 2HL, 2H Univ., H.S.
Milwaukee No. 2H Plain.
Van Norman Duplex, 12, 20, 22L, 36.

MILLS, VERTICAL
Index, Jackson
Brown & Sharpe No. 2 Standard.
Cincinnati No. 4, Hi-Power.
Gorton No. 8D, 9J Plain.
Morey No. 12M Profiler 2 sp.
Sipp MP5 Jig Borer.

PRESSES
Bliss No. 18, 19, 20, OBI.
Bliss No. 304A, 4" Str. 23"x24" bed, #306 w. Air Cushion.
Bliss No. 645B, 650, 675 Hi-Production, 58, 62, 62A, 162.
Bliss No. 8 42"x96", 250 Ton
Bliss No. 4½ Double Action Cam Gen. flexible Screw Press.
Henry & Wright Dieing, 25 Ton, 75 Ton.
I. & J #2, 4, O.B.I.
Reliance 45 Ton, O.B.I.
Z. & H. 30 Ton, O.B.I.
Stokes Tablet Presses, Model R & T, DD2, & Colton Tablet Presses.

TURRET LATHES
Acme No. 4W, 6W Bar and Chuck, Acme Fox.
Bardons & Oliver No. 3, 1⅛" cap., No. 5, Chuck.
Brown & Sharpe No. 1, 2F
Foster No. 3H.
Gisholt No. 4, 5 Bar and Chuck, 2L, Saddle Type
Warner & Swasey No. 3, 5, Preselector, No. 4A 3" Cap.

MISCELLANEOUS
Band Saw: Tannewitz No. 36M.
Bending Roll: Buffalo No. 0, Buffalo Wrapping Roll No. ½.
Broach: American Horiz. Hyd. H-15-60.
Hacksaw: Marvel Nos. 6 and 6A Automatic Feed.
Marking Machine: Noble & Westbrook
Notching Press: Ferracute C82.
Pin Machine: Nilson.
Shaper: Sheldon 12" Brand New
24" Rockford Hyd. Heavy Duty.
Hones: Micromatic Hydrohoner, Sunnen.
Keyseaters: Mitts & Merrill, Baker, Burr, Davis.
Rivet Hammers: Hi Speed, Chic. Pneumatic.
Toolmakers Microscope: Gaertner, Bausch & Lomb, Leitz
Router: #55 Oliver.
Tapper: Bakewell #1, #2G, Haskins 2C.
Haskins No. 3C, 3CAM.
Welders: Spot & Seam: Thompson, Taylor, Winfield.

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7¼" RA-4 Acme-Gridley, Latest.
6" RPA-8 Acme-Gridley Chucker, 1941.
16" Bullard Mult-Au-Matic, 6 spdl. 1941.
3½" RA-4 Acme Gridley, 1942.
3½" Cleveland Model A, 1943.
2½" Cleveland Model A, 1943.
2¾" RA-6 Acme-Gridley, 1943.
1⅝" Greenlee, 6 spindle, 1942.

BOLT MACHINES

No. 500C Manville Thread Roller, Latest
No. 250C Manville Header, SSSD, Latest

BORING MACHINES

No. 42 Lucas Horizontal, 1940.
No. 2112A Jr. Excello, 1942.
No. 54 Excello Double End, 1940.
No. 46B Heald Single End, 1940.

GEAR EQUIPMENT

3" Gleason Generator, 1941.
No. 6 & 17 Gleason Testers, 1943.
12" Red Ring Internal Shaver, Late.
No. GCL Red Ring Shaver, 1942.
No. 624A3 Fellows Side Trimmer, New.
No. 645A3, 615A & 61A Fellows, 1944.
No. 7 2 & 72 Fellows Shaper, 1943.
Vinco Spline & Gear Grinder, 1942.

GRINDERS, CYLINDRICAL

25"x48" Landis, Crankshaft, Like New.
16"x36" Cincinnati Plain, 1942.
12"x48" Cincinnati Univ, 1943.
10"x72" Landis Plain, 1942.
10"x18" Norton Plain, 1942.

GRINDERS, INTERNAL

No. 74 Heald Ext. Bridge, 1941.
No. 72A3 & A5 Heald Plain, 1944.
No. 5 & 16A22 Bryant, Latest.

GRINDERS, SURFACE

12"x16"x60" Thomsen Hyd. Latest.
No. 22 & 25A Heald Rotary, 1943.

LATHES, ENGINE

45"x192" Axelson, 1942.
24"x168" Sidney, 1942.
18"x54" Lodge & Shipley, 1943.
16"x54" Springfield, 1943.
16"x48" Bradford, 1942.

LATHES, PRODUCTION

Gisholt "Simplimatic", 1940.
No. 3A L&S "Duomatic", 1943.
No. FU Foster "Fostermatic", 1943.
9"x108" Lo-Swing Semi. Auto, 1942.
Model 8 Sundstrand, 1942.
14"x42" Monarch "Magna-Matic", 1941.

LATHES, TURRET

42"x36" Bullard Vertical, 1943.
No. 1A, 2A & 3A Warner & Swasey, 1943.
No. 1 & 81⅛"x24" Acme Univ, 1943.
No. 2, 3 & 4 Warner & Swasey, 1943.
No. 2, 3, 5 & 7 Bardons & Oliver, 1942.

MILLS, PLAIN

No. 5 Cincinnati, 1943.
No. 4H & 4K Milwaukee, 1943.
No. 3 & 32 Van Norman, 1942.
No. 2HL Milwaukee, 1942.

MILLS, PRODUCTION

No. 1-14 & 2-20 Kent Owens, 1942.
M-18 Kearney & Trecker, 1943.
No. 1224 Kearney & Trecker, 1942.
No. 3-36 Cincinnati Duplex, R & F, 1942.
No. 1-18, 2-18 & 2-24 Cincinnati, 1942.

MILLS, THREAD

12"x54" Lees Bradner, 1943.
6"x36" Lees Bradner, 1942.

MILLS, UNIVERSAL

No. 2MH Cincinnati, 1942.
No. 2H Milwaukee, 1942.
No. 2SU Van Norman, 1942.

MILLS, VERTICAL

No. 3B P&W Univ. Die Sinker, 1943.
No. 2K & 3H Milwaukee, 1942.
No. 2 & 3 Cincinnati, 1942.
No. 1 Cleveland, 1942.

PRESSES

No. 40-S½ Minster, 1942.
100 Ton Hannifin, Hyd. Str. 1942.
50 Ton Denison, Hyd. Str. 1942.

SHAPERS

24" Gould & Eberhardt Univ. 1942.
25" Smith & Mills Univ. 1945.

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Northern Hyd. Pump, 15 GPM, 15 HP, 2000	750
Chicago Pneumatic Comp. '43, 300 CFM, 100#, 50 HP	1295
I.R. Comp., '43, 60 PSI, 500 CFM, 100 HP	1950
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Sullivan Angle Comp., 455 CFM, 100#	750
Gardner 15x9x10, 700 CFM, 100#	880

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9-J Gorton Vertical Miller with Electric Duplicator
#3MS Cincinnati Dial Type Plain Miller
8L-3620 Keller Duplicator
8L-2416 Keller Duplicator
61-A Fellows Gear Shaper

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No. 49 New Britain, 4 Spdl. Chucker
Model A 3¼" Cleveland (1942)

DRILLS
No. 150 Baker (1942)
No. D8 Colburn, No. 6 Morse Taper
No. 200—36" Defiance #5 Taper (1943)
No. 1-LMS Leland-Gifford (1942)
No. 2-LMS Leland-Gifford (1942)
No. 4-BM Fosdick 6 Spdl. (1942)
No. 4BL Natco 36 Spdl. (1943)
3'-10" American Triple Purpose, M.D.
3'-10" Fosdick
4'-11" Carlton Radial Drill
5'-14" Fosdick
5' Western Heavy (1942)
6'-17" Fosdick Hyd. Economax Radial

GEAR MACHINES
No. 61-A Fellows Gear Shaper (1942)
No. 71-A Fellows Gear Shaper (1942)
No. 7125 Fellows (1943)
No. 72 Fellows Gear Shaper
72" Cincinnati Gear Cutter
No. 3 Barber-Colman Hob Sharpener

BORING MACHINES
No. 31 Lucas 3" bar, M.D.
No. 32 Giddings & Lewis, 3½" Bar
No. 2 Lambert 4" bar
No. 48-B Heald Bore-Matic (1942)
No. 112—C Excello 2 Spdl. (1942)
36" Bullard Hi-Speed (1942)
42" Bullard (1944)
42" Bullard New Era

60" Colburn, M.D.
72" Niles-Bement-Pond
84" Betts, M.D.

GRINDERS
3"x12" Brown & Sharpe No. 5 (1944)
4"x12" Landis, Model H (1942)
6"x18" Norton Type C Plain (1943)
6"x30" Norton Type C Plain (1943)
10"-14"x36" Norton Type C Plain (1943)
10"x18" Norton Type C Plain (1943)
10"x48" Norton Type C Plain (1943)
10"x96" Landis Type C hydraulic (1942)
Norton Motorized Grinders ranging from 6"x18" 24"x240"
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No. 34 Abrasive Surface Grinder (1943)
No. 36-A Nazchetti Rotary Surf. (1942)
No. 72-A-3 Heald Internal (1942)
No. 72-A-5 Heald Internal (1942)
No. 16—38 Bryant Internal Gdr.

LATHES
15"x54" centers LeBlond (1941)
18"x8' Americas, Gdr. Head, M.D.
24"x14' Monarch
36"—48"x16' Lehman Hydratrol (1945)
8"x15" Sundstrand, Model D (1943)
10" Sundstrands (1942, 1943)
16" & 20" Fay Automatics (1942)
Model B-14 Seneca Falls Le-Swing
No. 3 Warner & Swasey
No. 3 Jones & Lamson Univ. Turret Lathe
No. 4 Gisholt Univ. Turret Lathe (1942)
No. 4R Libby, Bar Feed (1942)
No. 5 Bardons & Oliver (1942)
No. 1-H Libby, Extra Long Bed (1942)

MILLING MACHINES
No. 2H Milwaukee Plain (1942)
No. 3B Milwaukee Plain
No. 2M Cincinnati Vert. (1941)
No. 3 Cincinnati H.P. Vertical
No. 1-18 Cincinnati Mig. (1942)
No. 2—18" Cincinnati Rise & Fall (1941)
No. 2—16" Sundstrand-Electromil (1942)
No. 2-24 Cincinnati
No. 4-48 Cincinnati Hyd. Tracer (1942)
No. 34-48 Cincinnati Hyd. Duplex (1943)
No. 45-48 Cin. Hyd. Tracer (1941)
No. 54-72 Cincinnati Hydromatic
No. 54-90 Cincinnati Hydromatic
4½"x12" Pratt & Whit., Model C Thread Mill
6"x36" Lees-Bradner—Model HT (1943)
10"x48" Hanson-Whitney Thread (1942)
12"x24" H.T. Lees-Bradner (1942)
24"x24"x12' Ingersoll Adj. Rail Slab Miller
36"x24"x12' Ingersoll Duplex Miller (1946)
No. 10 Ingersoll 72"x8' Travelling Col. Face Millers (1942)
No. 28-60 Cincinnati Hydrotel

MISCELLANEOUS
12" Vernon Shaper
25" Smith & Mills Shaper (1946)
18" Dill Slotter
Micromatic Vertical & Horizontal Hydrohoners

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48"x48"x13' Cincinnati, 4 Heads

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48"x20' cc DRIGGS Geared Head Lathe

48"x30' NILES Heavy Duty Geared Head Engine Lathe, new 1939, taper, steady rests, MD

60"x20' NILES BEMENT POND 24 Speed Geared Head Lathe, taper, steady rest

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10"x48" NORTON Type C Hydraulic Cylindrical, Grinder, 1942

20"x96" NORTON Type A Cylindrical Grinder

4' HAMMOND Jackknife Radial, 1942

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84" CONSOLIDATED COLBURN Vertical Boring Mill, 2 swivel heads, rapid traverse, AC —MD

100" SELLERS Vertical Boring Mill, 2 swivel heads, rapid traverse, new 1935

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No. 4 CINCINNATI Plain Mill, with motor driven vertical head, 1942

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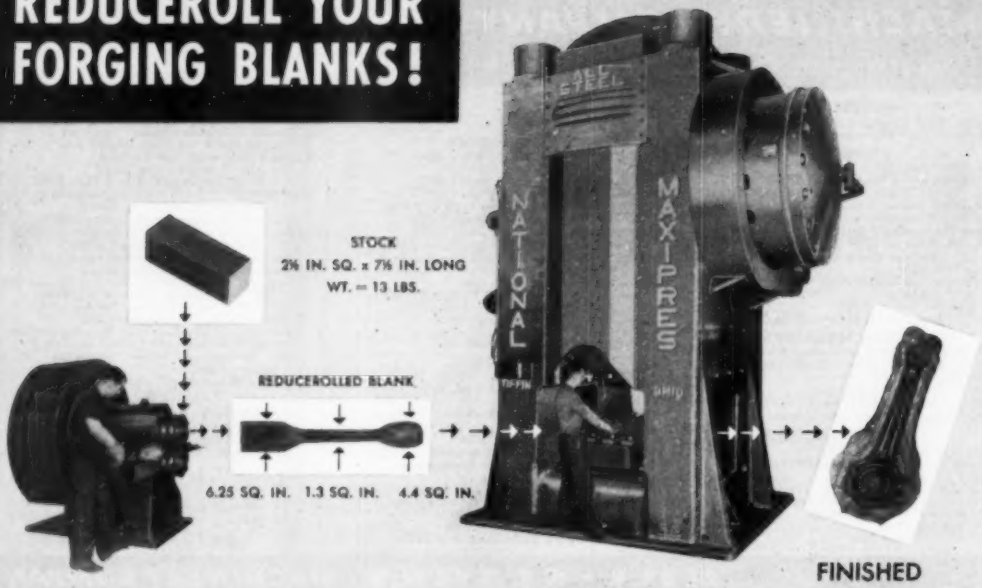

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Forge men agree that connecting rod forgings, like the 13-pound rod shown above, have always presented difficult forging problems. This has been due to the large differences in section between the crank ends and the webs.

Note in the "REDUCEROLLED Blank" illustration that the cross-sectional areas of the properly prepared blank vary from 6.25 sq. in. to 1.3 sq. in. Follow the arrows for a visual explanation of how REDUCEROLLING simplifies the forging of this part.

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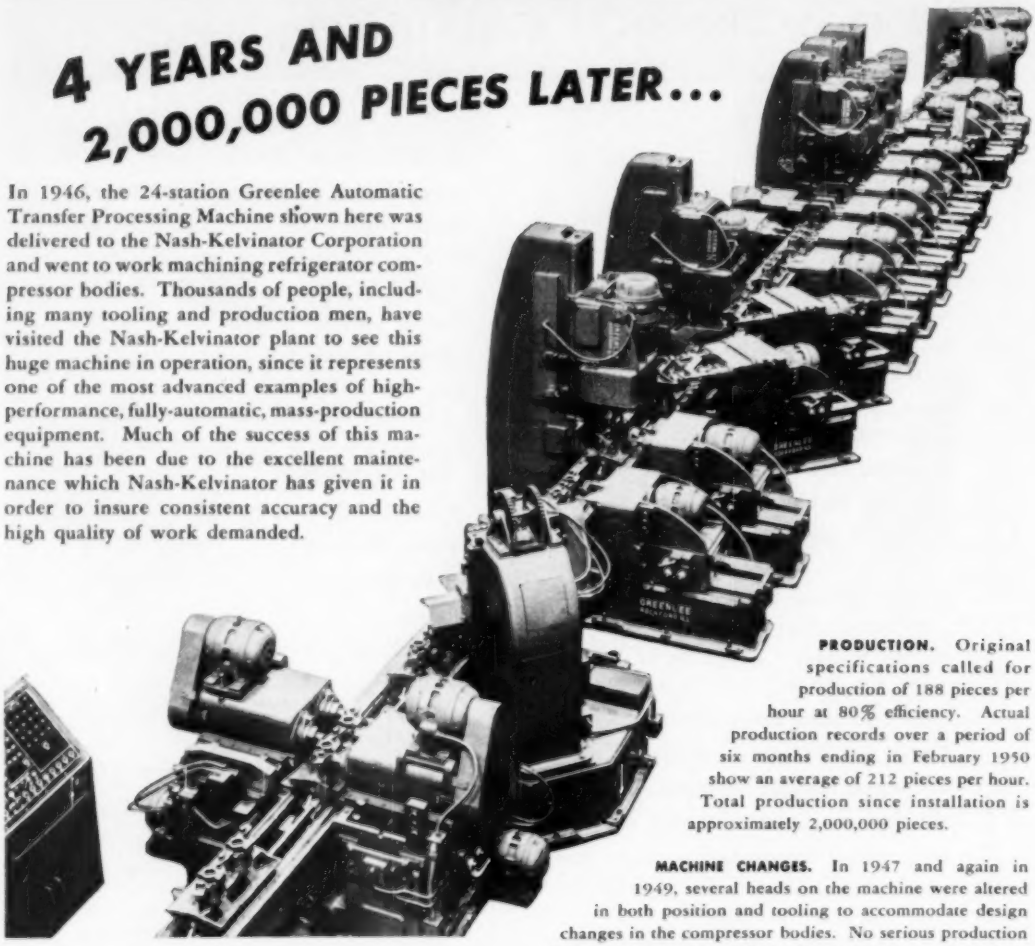
REPORT ON A **GREENLEE** ACHIEVEMENT

4 YEARS AND 2,000,000 PIECES LATER...

In 1946, the 24-station Greenlee Automatic Transfer Processing Machine shown here was delivered to the Nash-Kelvinator Corporation and went to work machining refrigerator compressor bodies. Thousands of people, including many tooling and production men, have visited the Nash-Kelvinator plant to see this huge machine in operation, since it represents one of the most advanced examples of high-performance, fully-automatic, mass-production equipment. Much of the success of this machine has been due to the excellent maintenance which Nash-Kelvinator has given it in order to insure consistent accuracy and the high quality of work demanded.



PRODUCTION. Original specifications called for production of 188 pieces per hour at 80% efficiency. Actual production records over a period of six months ending in February 1950 show an average of 212 pieces per hour. Total production since installation is approximately 2,000,000 pieces.

MACHINE CHANGES. In 1947 and again in 1949, several heads on the machine were altered in both position and tooling to accommodate design changes in the compressor bodies. No serious production loss was involved in making these alterations. This illustrates the flexibility of Greenlee design.

SCRAP. Not over one or two pieces a week are scrapped for reasons attributed to the operations on the Greenlee, according to Nash-Kelvinator officials . . . a commendable record considering the number of pieces processed.

ROUGH CASTING FINISHED PIECES

THE PIECE machined on the equipment shown above is a cast iron compressor body for residence type refrigerators. The work goes through the machine on special fixtures carrying two pieces each. A total of 152 operations are performed, using 50 drills, 12 face mills, 2 side mills, 2 end mills, 12 boring tools, 38 chamfering tools, and 36 taps.

PRODUCTION MACHINERY

GREENLEE

GREENLEE BROS. & CO.

1725 Mason Ave., Rockford, Illinois

MULTIPLE-SPINDLE DRILLING, BORING, TAPPING MACHINES • AUTOMATIC SCREW MACHINES • AUTOMATIC TRANSFER PROCESSING MACHINES

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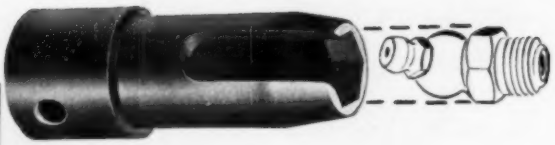

Square Drive Socket for Zerk Grease Fittings

SOCKETS & WRENCHES

Hex Drive, Tension Type Universal Wrench

• For real production tool economy, look well beyond the original tool costs. The "Savings" made on lower first costs can be quickly dissipated — many times over — through losses in production time . . . caused by quick wear-out and tool breakage.

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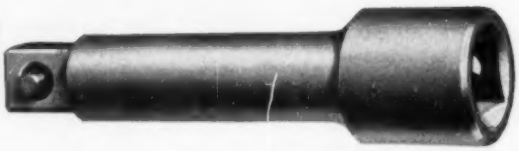
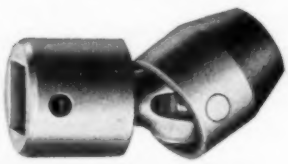


Extension Socket Adapter Male and Female Square Drive

Driver for Socket Screw



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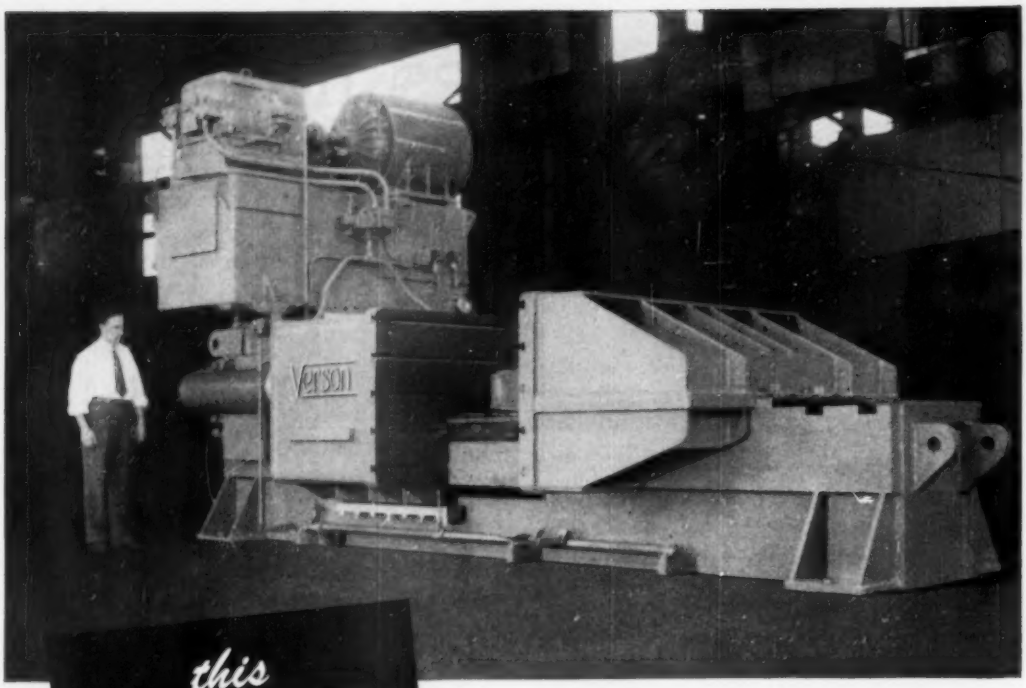

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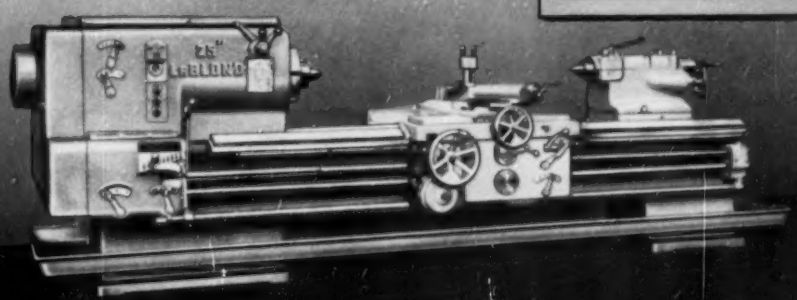

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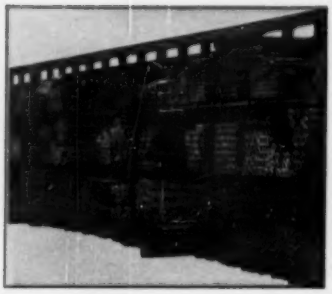

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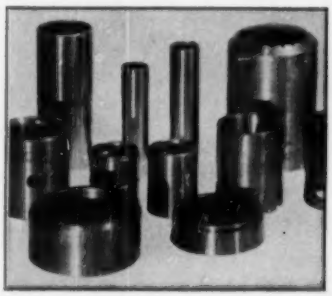

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